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ABSTRACT

It is of critical importance in the Asia/Pacific region to produce quality science books which are attractive and interesting for children and youths and which can also stimulate their interest in science and provide them with accurate scientific knowledge in an easily understandable way. This publication is a report of a training course on book production in Asia and the Pacific. Part I, "Writing Science Textbooks," contains: "Science Education in Japan and Science Textbooks" (Kazuyoshi Takeda); "Editing Science Textbooks" (Wataru Nomachi); "Theories & Techniques for Writing Primary Science Textbooks" (Michio Kaneko); "Writing Science Textbooks for Secondary School Level" (Kazuyoshi Takeda); and "Practical Sessions on Writing Science Textbooks for Secondary School Level" (Kazuyoshi Takeda). Part II, "Producing General Science Books for Children & Youths," contains: "Discovery of Wonders of Nature" (Toshitaka Hidaka); "Fun & Games & Science & Literature & Education" (Vicki Cobb); "My Experiences on Writing Science Books for Children" (Takahisa Manya); and a practical session by Vicki Cobb and Takahisa Hanya. Part III, "Present Situation of Science Book Production and Constructive Suggestions," contains: "Practical & Constructive Suggestions for Producing Good Science Books for Children & Youth (by new Practical Method data analysis) and "The Characteristics of Science Textbooks in Respective Countries and the Problems of Writing Science Books for Children & Youths" (participant's reports from Bangladesh, Bhutan, China, India, Indonesia, Iran, Laos, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Pakistan, Papua New Guinea, Philippines, Republic of Korea, Sri Lanka, Thailand, Viet Nam, Columbia, and Kenya). Five appendices include a list of participants, program schedule, a list of lecturers, and a list of secretariat members. (JRH)

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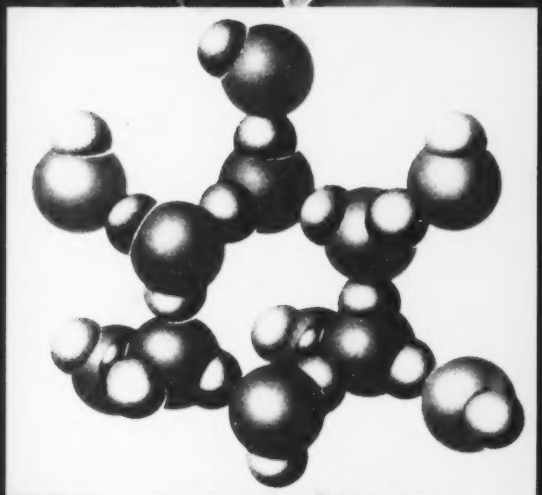
# How to Write Good Science Books for Children & Youths



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Report:

25th Training Course on Book Production in Asia and the Pacific

30 October–16 November, 1992

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Asian Cultural Centre for UNESCO (ACCU)
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## *Preface*

The Training Course on Writing Primary Science Books - 25th Training Course on Book Production in Asia and the Pacific - was organized by the Asian Cultural Centre for UNESCO (ACCU) with assistance from UNESCO and with the co-operation of the Japanese National Commission for UNESCO, the Japan Book Publishers Association, the Japan Foundation and the Japanese Board on Books for Young People, from 30 October to 16 November 1992, in Tokyo.

The role of science in developing the society and ability of the people is becoming greater in the present society. It is of critical importance in the Asia/Pacific region to produce quality science books which are attractive and interesting for children/youths and which can also stimulate their interest in science and provide them with accurate scientific knowledge in an easily understandable way. This course for writers was one of the series on the production of science books which included the course for editors in 1990, and illustrators/designers in 1991, as the co-operation between these experts is essential to achieve the goal - production of quality science books.

This Training Course is part of the Asia-Pacific Co-operative Programme in Reading Promotion and Book Development (APPREB) which UNESCO promotes for the development of publishing and reading in the region. 24 participants from 21 countries took part in the course including two from Africa and Latin America, who were invited with co-operation from the Japan Foundation.

The first part of the course concentrated on textbook writing, as the improvement of textbooks is one of the most urgent needs in respective countries. Writing general science books for children/youths was also discussed in the second part. The distinguished experts in the field of science, science education, textbook production, and writing/editing of science books were invited to the course as lecturers.

ACCU would like to express our heartfelt appreciation to the lecturers and advisers for their kind contributions to the success of the training course. Our deep appreciation also goes to respective National Comissions for UNESCO of 19 countries in Asia/Pacific, the Centro Regional para el Fomento del Libro en America Latina y el Caribe (CERLALC) in Colombia and the Council for the Promotion of Children's Science Publication (CHISCI) in Kenya.

We hope that this report will help to improve the quality of science books for children/youths in each country.

*Asian Cultural Centre for UNESCO*

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*Bangladesh, Bhutan, China, India, Indonesia, Iran, Laos, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Pakistan, Papua New Guinea, Philippines, Republic of Korea, Sri Lanka, Thailand, Viet Nam, Colombia, Kenya*

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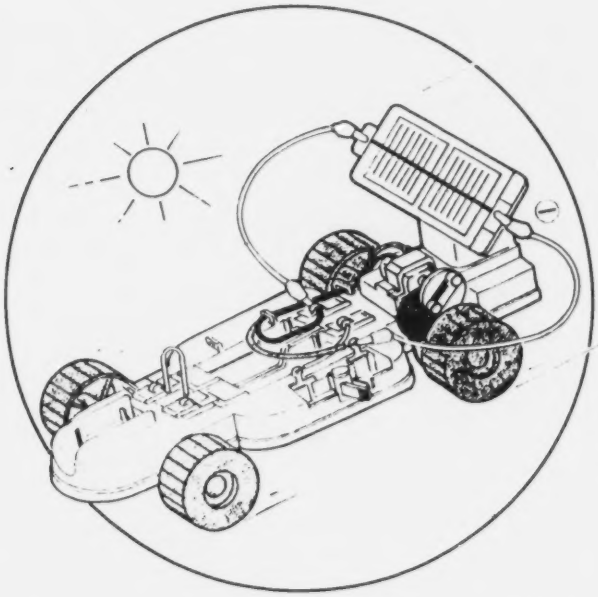
# PART I.

## Writing Science Textbooks



# 1. Science Education in Japan and Science Textbooks

Kazuyoshi Takeda
Lecturer
Tokyo Science University

## Education and Textbook from 1870 to 1945

Modern education started in 1872 and the roles of primary school, junior high school, university were determined by the Education Law. Primary school education was made compulsory. We can assume that science teaching was emphasized in primary school education. The Japanese Government in this era was trying to catch up with western countries by introducing their advanced knowledge. So, the emphasis was on teaching knowledge to children rather than encouraging children to think by themselves.

In 1874, a textbook edited by the Ministry of Education itself was published.

In 1879, An Educational Ordinance was launched and an announcement on the educational guidelines for elementary science study was made. A group of people who had studied abroad started the "development teaching method" movement. It was a new challenge to seek out subjects not related to academic categories but to the students' everyday life.

Many good textbooks were published by sources other than the Ministry of Education, but most of them were translations of foreign science textbooks.

In 1886, The word "science" was used as the subject's name for the first time. Children learnt things and phenomena in nature, not the about basic natural law. There was no science class in junior primary school (1st grade to 4th grade); it was given only in senior primary school (5th and 6th grade).

In 1886, the Ministry of Education established the "Textbook Examination Act" which was effective till 1903.

In 1900, science was defined as "phenomena of common physics and chemistry, important elements and compounds, structure of simple machines and their use, and summary of life".

In 1907, 6-year compulsory education was established. Science classes started from 5th grade, and natural history was added to the previous curriculum.

In July 1910, national textbooks were published and their use in all schools throughout the country was made compulsory. They were used until 1941. Note that they were not called 'textbooks' but 'science books'. Textbooks were used only by teachers and this book was prepared for the children as they had difficulties in taking notes. It was a monotonous collection of very simple explanations and knowledge obtained from studies.

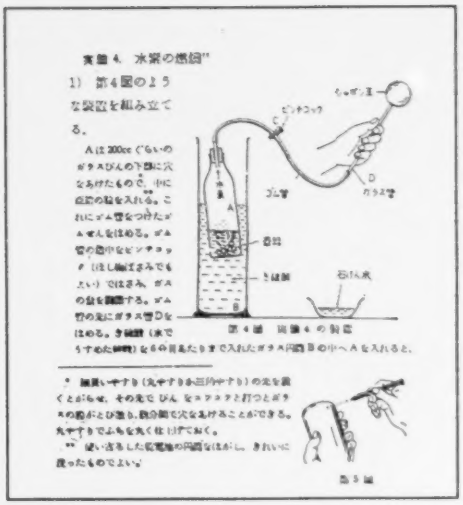
They started giving science classes to 3rd grade students in 1941. The need for earlier science education was acknowledged and a "nature observation" class was created. The textbooks for this subject had quite high-level contents and adopted a unique approach which let the children try, observe and think by themselves. however, this kind of good education did not last long.

## Reforms of the Course of Study and Outline of Textbooks after 1945

1. General Reforms of the Course of Study

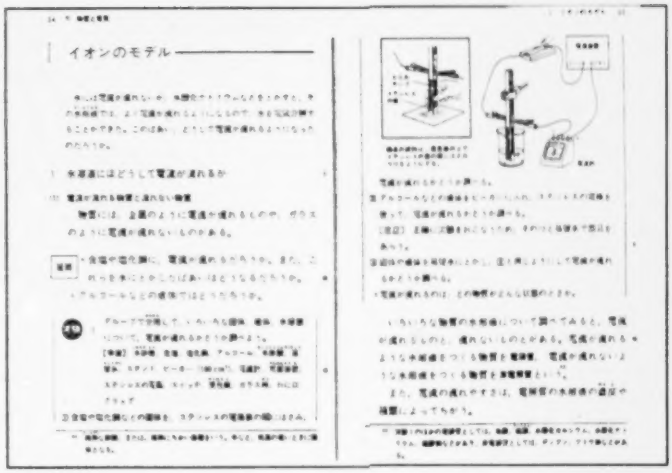
In 1945, after the Second World War, the old educational system was totally scrapped, and the Ministry of Education announced the "New Educational Guideline". The plan to democratize education was embodied through establishment of "Basic Educational Law" and "School Educational Law" and through the establishment of a 6-year, 3-year, 3-year, 4-year school system which aimed at unification of the education system.

With the introduction of the new school and education system, a Course of Study was established to replace its pre-war counterpart. This Course of Study was "organized as a guideline for teachers who are supposed to research how they can make this newly born educational system effective". This plan was made "standard" in 1953.



"Burning of Hydrogen"
from *How Can We Use Fire -Our Science Series 3*
for 1st grade in junior high school (1949)

"Ion Model" from *New Science*
textbook for junior high school (1971)



Since then, the Course of Study in Japan has been revised drastically about every 10 years. The concept of science study in secondary school has changed from everyday life study on empiricism, to systematic curriculum, to research curriculum with emphasis on research science and scientific methods, and to curriculum with emphasis on the individual. These curricula, however, did not supersede one another, but tended to overlap, so that each curriculum has been inherited in part to this day.

2 Course of Study which Favours Everyday Life Study

(1)"A draft" of the 1947 junior high school Course of Study

J. Dewey's "learning by doing" had a strong effect on education in Japan after the war and, led to pragmatism and 'everyday life' study, in which subjects of science study where related to students' everyday life, and the subject was used as the base to make their life more fruitful. To this purpose, the following 3 goals were established.

1) To treat objects and phenomena with scientific method.
2) To obtain knowledge of the principle and application of science
3) To seek out the truth and to create new things voluntarily.

To attain this goal they selected the following 5 fields of study to be covered from 1st grade in elementary school to 3rd grade in junior high school without interruption.

(a) Animals, Humans (b) Plants (c) Lifeless things, environment (d) Machines, Tools (e) Health

What we have to note is that in the Course of Study at that time, it said "Though this is about how to teach, it was also intended as a guideline for teachers who are supposed to find out ways to make this newly born educational system effective."

(2)"A draft" of 1951 junior high school and high school Course of Study (revised)

There was not enough effort being put into 'everyday life' study. Furthermore, the Course of Study of 1947 did not adequately provide for 'everyday life' study and problem-solving study. Therefore, to fulfill the need for the principle of everyday science, this revision included concrete examples of problem solving study.

There were 16 detailed goals for science study which included scientific goals such as those in the emotional field. the ability to apply scientific method and the habit of precise observation, measurement and records. Thus the revised '51 version moved one step beyond the goal set in the Course of Study in 1947, and the problem-solving study on empiricism was implemented throughout the nation.

However, with this method, too many students were brought into the study, resulting in fragmentary knowledge. It was difficult to relate what one was studying with what one had studied

and there was severe criticism that it did not lead to a systematic knowledge. With much criticism to the effect that there was no basic understanding of science and that basic ability was lacking or lost, 'everyday life' study was forced to take another step.

As you can see now, there were a number of problems in 'everyday life' study. But students were very enthusiastic about studying because they could relate it to their everyday life.

The reason for the criticism of the 'everyday life' study and the problem-solving study was not just the method itself. It was more due to the lack of teachers' ability to teach and inferior facilities of schools. It is so, and is even now, that teachers who were familiar with teacher-centered knowledge-giving, were not very good at, nor were trained for, methods of 'everyday life' study and problem solving study. Moreover traditional knowledge orientation could not easily be changed to experience-oriented curriculum and it was gradually lost without ever having been absorbed. We will see the reason for this again when we talk about the loss of research study later on.

3. Systematic study-oriented Course of Study

With the rise of criticism regarding 'everyday life' study and problem-solving study, in commerce and economy, larger trade and rapid growth of economy caused a need for human resources in the industry and science of Japan.

Meanwhile in America, with criticism of progressive learning by minimum essentialists, the idea that students should obtain a minimum amount of systematic knowledge was gaining strength. With this consideration, 'everyday life' study was revised this time give the minimum amount of systematic knowledge necessary. For this purpose, the contents of junior high school science had to be restructured to match the system of natural science and to make them teachable. With this background, '58 Course of Study revision was established. The biggest feature of this revision was that it was made independent of America and had the characteristic not of a "draft" but a "standard". From this point on, Course of Study became rather a restraint than a guideline for teachers.

One other feature is that it divided the contents of junior high school science into 2 fields, 2 hours for each field. The aim of this dual field system was to make use of previous universal science and to absorb the gap of this drastic change.

For this dual field system, 3 textbooks, one for each grade, were published. Each book had considerable contents for systematic study.

4. Research science-oriented Course Guide

As knowledge-oriented science education proceeded, the technology, culture and industry of Japan took a large step forward. Furthermore, there was an 'age of information' boom, with a number of scientific and technological break-throughs being made throughout the world. Naturally, to know the process of the research and to be able to draw conclusions from information were more important than to know the results of the research.

In addition, the movement for education reconstruction started in America had become centred on modernization of science education and had a strong effect on Japanese science education.

These reconstructions placed more emphasis on process and scientific method than individual knowledge itself. Furthermore it was constructed to cover the principle of modern natural science. With such a background, the 1969 revision of Course of Study was made and 3 principles were established.

(1) Promotion of basic ideas of natural science.
(2) Learning the process of research and scientific method.
(3) Selection of contents.

There was much talk about "science of research". However, the contents to be covered were much more than class time would allow and teachers were inexperienced in systematic teaching. These resulted in the loss of this idea without much success.

5. Human-oriented Course of Study

The rapid growth of the Japanese economy has lead the society to be educational-background-oriented and disregard humanity in the shadow of materialism.

The Education philosophy that each student should be able to obtain education according to ability gained popularity. This is the basic idea of the human-oriented education. Furthermore, pollution, which was a big social issue at that time, made people think that welfare was more important than any other issue.

With such background, '77 junior high school Course of Study was established and 4 principal

goals were set.

(1) to promote humanity among students
(2) to have a nice school environment
(3) to put emphasis on both basic knowledge necessary for citizens of the society and education matched to individual ability.
(4) to present the contents of this Course of Study simply as a core and to let teachers have their own way of teaching.

But the word 'basic' misled many teachers to think that they only had to teach knowledge of science.

6. Individual-oriented Course of Study

Teacher-centered knowledge delivery type of teaching tended to deprive students of their will to learn, nor was the knowledge learned put to use in the society, and people started to point out the students' lack of ability to solve problems. At the same time, the value system of the people had diversified and individualism was becoming established. As Japan started to play an important role in the world, internationalization became an important issue in Japan.

With regard to such things, the Committee of Educational Process made an announcement on "revision of the standard for educational process in kindergarten, elementary school, junior high school and high school" and presented 4 basic aims.

(1) to produce lively and emotionally rich people.
(2) to promote the will to study and ability to actively react to the changes in the society.
(3) to aim education to heighten the individual's ability and with emphasis on providing basic knowledge needed as a citizen.
(4) to promote international understanding and Japan's own culture and tradition.

With this, science in junior high school was reconstructed as follows:

(1) even more emphasis on real experiences such as experiment and observation.
(2) emphasis on problem-solving ability.
(3) emphasis on scientific approach to nature.

Other than these, other features of this change included use of computers for science study, flexible use of time in the 3rd grade (=9th grade) and optional science class other than mandatory ones.

As I have mentioned here, the Course of Study went through several changes before its present form. The concept of science education has shifted from teaching knowledge of natural science to teaching with real experience through experiments and observations. Also teaching style has shifted from monotonous uniform teaching to individual-oriented teaching.

However, it is questionable whether the classes taught in junior high schools are effectively making best use of the above concept. The reality is that students in junior high school have little interest in science and do not want to do experiments and observation, nor do they actively interact with nature. To change this, it is very important for the teachers to change their views on education, study, students, evaluation, ability and so on.

Mr. Takeda giving instructions at the practical session.

## 2. Editing Primary Science Textbooks

Mr. Wataru Nomachi
Editorial Director
Tokyo Shoseki Publishers

The general goal/motive of science textbooks of Japan is defined as;

1) To initiate interest in nature
2) To enhance scientific logistics
3) To develop experimenting skills
4) To enhance understanding and knowledge of natural phenomena

However, the fierce competition of entrance examinations has been casting a shadow over science education. The emphasis put on high achievement scores on written paper tests creates a serious problem and leads only to the discouragement of children's interest in science.

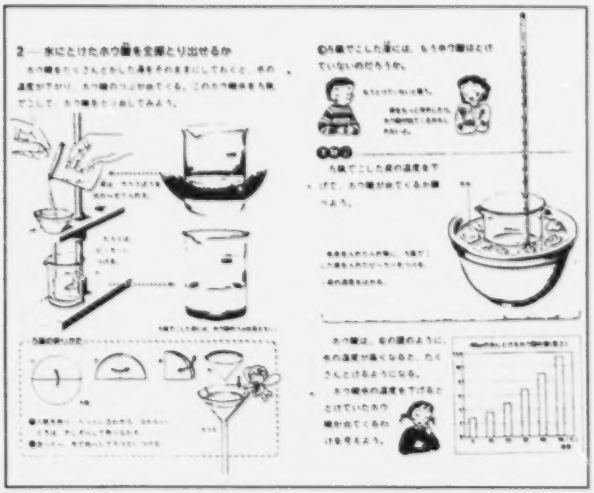
To solve the above problem, the new national curriculum which will be adopted from the spring 1993 emphasizes the following activities;

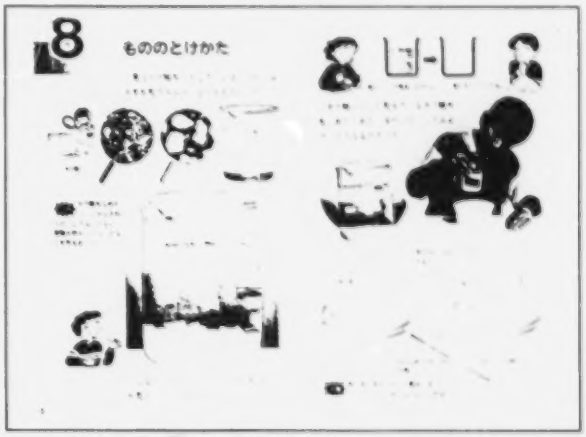
1) To increase the opportunities of the children to come in to contact with and enjoy nature.
2) To increase the number of experiments
3) To increase the opportunities of children to find answers to the questions about nature by themselves. (Increase the number of search-oriented activities or project-oriented activities).

Every textbook publisher produces its own textbook according to the curriculum to cover all these contents. Together with university professors, elementary and junior high school teachers, experts in natural sciences on editing committee create the draft for the textbook. Photographers, and illustrators also contribute in making the draft.

Experiments are creative measures to get children interested in the subject. The child makes guesses and with an inquisitive mind, wants to investigate further. Tokyo Shoseki textbooks are creatively designed to arouse the children' s interest and are rated highly in the field of science textbooks.

The page making of a textbook is significant. It stirs the child's interest and desire to learn. Also, teachers must feel the textbook contains interesting teaching materials. In order for that to happen characters introduced throughout the textbook play a vital role in creating this interest. Photographs of lively children used in the classroom can easily relate to the children they see in the textbook. In addition, precautions must be taken to ensure that photographs depict instruments being used properly in the experiments.






"How Do Objects Melt"
from Tokyo Shoseki's science textbook for 5th Grade

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# 3. Theories and Techniques for Writing Primary Science Textbooks

Michio Kaneko
Vice Principal
Elementary School attached to Saitama University

## New trends in science education

The education syllabus is revised every 10 - 12 years. From 1992, a new syllabus is being adopted. Specific objectives for revision at primary level are;

1) To cultivate the ability to solve problems through observation and experiments, and create a way of looking at and thinking of nature in a scientific manner.
2) The natural subjects for learning should reflect the regional situation, and educate through effective use of local natural occurrences.
3) The content of "Flora and fauna and their environment", "matter and energy", as well as "the earth and space" should reflect everyday life relating to science, in order to conduct the lesson in an applied, productive manner, as an independent problem-solving activity for the students.

For example, the aims of primary science are defined as follows;

> To encourage the student to love and understand nature, and develop the ability to observe, experiment, and solve problems. At the same time, to increase understanding of natural matters and occurrences, and to create a scientific point of view and way of thinking.

1)Purposely emphasize skills such as: observation, experiments, cultivation, and breeding. These activities should bring the students closer to nature and increase their in it.
2) In order to develop an interest in learning on their own, the students should experience the whole process of finding a problem and reaching a conclusion. That way, they should acquire the ability to solve problems.
3) To point out the characteristics or laws of nature seen in natural matters and occurrences; through basic learning relating to nature. By analyzing and explaining them, a scientific point of view and way of thinking should be bred.

## Writing science textbooks

The writing team consists of 20 to 30 members per subject including;
- Editors of the textbook publishing company
- Elementary school science teachers in the field (science researchers ) --- **emphasis on the flow**
- University, research institute's specialists --- **emphasis on the content**

The basic guideline is decided considering the following matters;

- Relevance to the education syllabus both in aim and content
- Number of pages in the textbook*
- Number of coloured and black and white pages*
(* decided in relation to the cost)

Also, the textbook's characteristics are decided. For example;

1) Make the problem-solving interesting and simple.
- Considering the development of the students, adapt the units to suit the students' way of thinking.
- Use devices for effective introduction.
- Use devices leading to easy hypotheses and predictions.
- Introduce various observations and experiments.
- Include devices on writing conclusions and readings.

2) Produce a textbook that is fun to look at,
- Through usage of photographs and illustrations and effective editing.

3) Include observations and experiments
- Using the whole body and all the senses -- sight, touch, hearing.
- Trying to use scrap and household materials.
- Interesting and impressive observation and experiments.

4) Select learning materials
- Use simple and new pictures and diagrams.
- Materials from different regions to be used throughout the nation.
- Introduce "readings" for comments in the middle

5) Introduce self-developing activities
- Materials to be studied at home during the summer vacation for self-development.

6) Arrange page composition
- Easily understandable and visually attractive composition
- Putting together photographs and illustrations.
- Dynamic photographs here and there.
- Folded pages and files.
- Fill-in-the-blanks type.

**An example of comprising and editing of a unit**

Example: Fourth grade elementary school
" How light batteries work"

The education syllabus of Ministry of Education defines the content of the unit as follows;

**Matter and Energy**
To examine how electricity and light work, by using dry cells and light batteries, light bulbs and motor
a) Depending on the number of dry cells, the light intensity or the speed of the motor can be altered.
b) Light bulbs can be used to power the motor and other things.

Here, the number of dry cells is altered to light the bulb, or turn the motor. By altering the numbers or the connection, it should be grasped that the bulb's brightness or the motor's speed will change.

In addition, the relation of the number of dry cells to the bulb's brightness and the motor's speed according to the amount of current in the circuit should be understood.

Through these activities, it should be evident that the changes in amount of current will result in the difference in the brightness of the bulb or the revolutions of the motor. At the same time, try to get them interested in the work of electricity and light, and foster a positive attitude for further research. (Comments by Ministry of education, education syllabus)

According to this, each publisher may decide the flow of the unit, taking into consideration the following matters;
- class periods in a year -- 105 hours
- teaching content -- ca. 9-12 units.
- season, climate, strength of light

**An example for a flow**

- title of the unit: "The work of electricity"
- amount of time spent: 10 hrs
- number of pages: 10 pages

- flow of the unit:
1) Make a battery-run car and let it run
- make a car that runs on dry cells
- make a car that runs faster
2) difference in the electricity's effects
- 1 dry cell -- less current -- slow
- 2 dry cells-- much current-- fast
- 2 dry cells-- less current -- slow
3) let it run on light batteries
4) readings and conclusion
- science readings etc.
- conclusion of the unit

Here it is expected that the children would have fun and get interested in the function of electricity through making battery-run cars and competing in a car race.

The participants also had a fun at the solar car race like fourth grade children. Mr. Kaneko explained how children learn the work of light butteries through this race

# 4. Writing Science Textbooks for Secondary School Level

Kazuyoshi Takeda
Lecturer
Tokyo Science University

**System of textbook examination**

In Japan textbooks for students of elementary school, junior high school, high school and the kind have to be examined in accordance with standard for the textbook examination established by the Minister of Education under the Textbook Examination Rule.

**Goal of the junior high school science course of study**

In junior high school science, there are goals and contents set by the course of study established by the Minister of Education. These goals are to; encourage interest in nature, carry out observations and experiments in order to promote understanding of nature and its phenomena, and scientific views and way of thinking.

**Ability to do research scientifically**

1) "Ability to research scientifically"

"Ability to do research scientifically" means series of problem-solving processes in which one seeks for problems in nature, collects information about them, processes it to find regularity in that and to have deeper understanding of that. It is called "process of research" or "scientific method".

Generally in junior high school students carry out research on the nature in the following manner.

1. Finding and identifying the problem

   Students either find problems to do research on by themselves or select from problems teachers have listed.

2. Collecting data about the problems

   Students collect data through observations, experiments and measurements, record and arrange it.

3. Arrangement and interpretation of the data.

   Students categorize the data and draw graphs and figures to arrange and interpret it.

4. Making up a hypothesis

   In accordance with sections 2 and 3, students make up a hypothetical solution to the problem.

5. Checking the hypothesis

   All the students check their own hypotheses through observations and experiments.

6. Correcting the hypotheses

   If the hypotheses are found to be wrong through the observations and experiments, students correct their hypotheses to find a new solution to the problem.

7. Check the corrected hypothesis

   The students recheck their hypotheses obtained in section 6 through observations and experiments.

8. Obtaining the subjective answer.

   The students reach their conclusions to the problems, make presentations on it and write up reports.

2) "Ability needed to do research scientifically"

Detailed process of scientific research of an object includes a lot of ability, including the thinking process. Therefore, for junior high school students, the 6 following "abilities to do research scientifically" are supposed necessary. These 6 abilities, categorized in detail, can be thought of as the goal of study.

interesting experiments attract children

*(a) Ability to find problems*

This is the ability to actually find a problem from nature or arrange the place of finding and find an appropriate problem to solve. The following skills are necessary for this.

- To be able to find a meaningful problem from natural phenomena.
- To be able to analyze the problem and recognize the important part of it.

*(b) Ability to collect data*

This is the ability to collect necessary information and data for solving problems through direct and indirect methods. The following skills are necessary for this:

- To be able to make an observation. (To be able to see things as they are and to compare them during the observation.)
- To be able to make a continuous long-term observation.
- To be able to make measurements. (quantitative measurement)
- To be able to collect related data and information from books, stories, movies and so on.
- To be able to pick up the abnormal data. (To be able to pick up data that is not normal quickly and recognize them as abnormal data.)

*(c) Ability to systemize the data and the information*

This is the ability to process and arrange the obtained data so that it can easily be interpreted through one's thinking process. The following skills are needed:

- To be able to find similarities and differences.
- To be able to categorize them according to a certain standard.
- To be able to relate them.
- To be able to recognize cause and effect.
- To be able to read data and charts correctly.

*(d) Ability to create*

This is the ability, in the process of solving the problem, to relate the new findings to what one already knows and to reach some original and creative solution. The following skills are needed:

- To be able to make a guess.
- To be able to predict the result.
- To be able to deduce from the facts.
- To be able to find regularity.
- To be able to apply laws and principles to the phenomenon.
- To be able to make up a hypothesis.
- To be able to use the appropriate model in solving the problem.
- To be able to check ones hypothesis and model.
- To be able to think freely without a fixed thinking process.
- To be able to correct one's mistakes continuously.

*(e) Ability to manipulate*

This is the ability to make appropriate observations and experiments effectively and safely and to plan and carry out observations and experiment to check models and hypothesis. The following skills are needed:

- To be able to make the basic manipulation for the observations and experiments.
- To be able to make the manipulation safely.
- To be able to plan appropriate experiments.
- To be able to point out and set the condition control and referential experiments.

- To be able to use new machines and tools for the experiments.
- To be able to make tools for experiments.
- To be able to raise plants and animals.

*(f) Ability to communicate (ability to express)*

This is the ability to communicate and express properly the result of the scientific method in a manner whereby the result can be checked by others. The following skills are needed:

- To be able to make subjective records.
- To be able to make charts and graphs.
- To be able to make equations to express.
- To be able to symbolize the result to express.
- To be able to make a presentation of the result in front of other people.
- To be able to write up a report of the result.
- To be able to make a self-evaluation of the result.

**Importance of observations and experiments**

1) A class in which students work on nature

For many science topics, real understanding is obtainable only through students working on the object and getting a hold of the understanding by themselves. By making them work on the nature using their own hands and minds, it is possible to promote the "ability to do research on nature". In doing so, observations and experiments are necessary.

2) Carrying out observations and experiments

1. Observations and experiments for getting information by oneself and not to give them that.
2. From group experiments to independent experiments.
3. Experiments using objects around us.
4. Carrying out of interesting experiments.

**The method of obtaining ideas and expression in the textbook.**

There are 3 ways in which students obtain ideas.

- through experience.
- through teaching.
- through working on the subject themselves.

In subjects like science where one obtains ideas of nature, No.3 is a very popular way. Therefore in writing an textbook enough consideration is needed on those 3 kinds of methods.

**Reformation of class and textbook**

Traditional knowledge-giving type of class is shown in Fig.1.

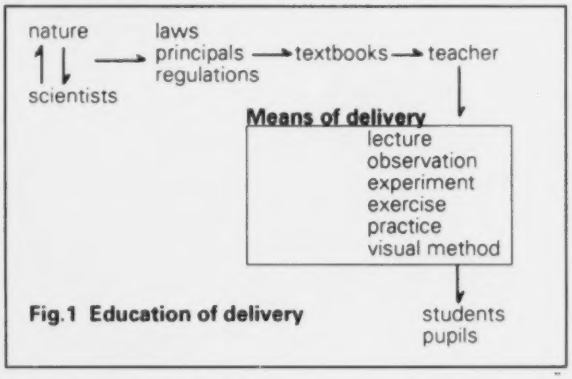



**Fig.1 Education of delivery**

Education of the future must be done in such a way that students do research on nature directly and build their own theory as shown in Fig.2. This is a very important kind of education called "promotion of the ability to research scientifically".

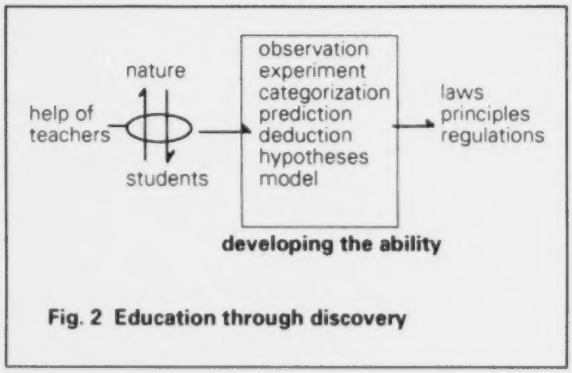



**Fig. 2 Education through discovery**

**Contents and expression of textbook of the future**

In making the textbook of the future, the following points regarding contents and expressions are important. Textbooks must have contents and a way of expression that:

- are interesting to study.
- are encouraging to study.
- promote the interest in nature.
- help the student to attain the scientific way of thinking.
- help develop the ability to make observations and do experiments.
- let students build up an understanding of natural science by themselves.

## 5. Practical Session on Writing Science Textbooks for Secondary School Level

Kazuyoshi Takeda
Lecturer
Tokyo Science University

After the lectures by Mr. Takeda and other experts in the field of science book production, participants were given some themes on which to write parts of a science textbook for youths by Mr. Takeda.

The participants were requested to write a text which would not teach them directly but from which the children could learn the basic scienctific principles, by using it. As mentioned in the lectures, experiments play an important role. Therefore, the participants were also requested to use these experiments as an attractive introduction to the study, and to conduct the experiments themselves so that they could include the results of the experiments in the texts. Here is shown part of the participants' work.

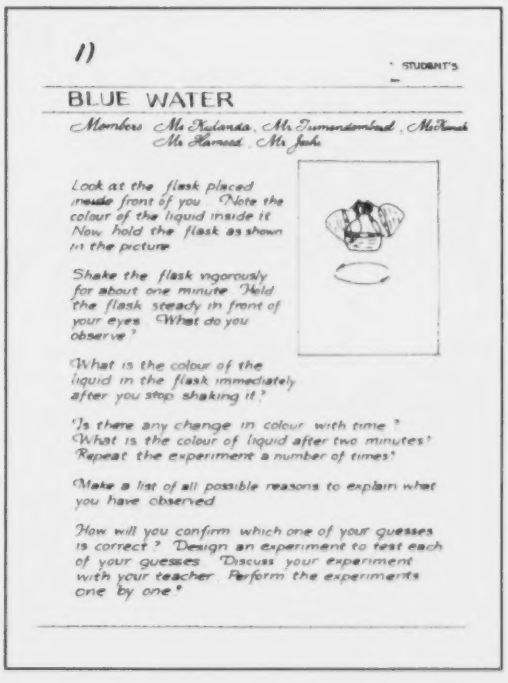
The Themes given by Mr. Takeda are as follows.

1. Blue Water
2. Black Box
3. Death Ring
4. Electromagnetic Induction
5. Electric Current in Series and in Parallel
6. Photosynthesis
7. Archimedean Principle, Buoyancy

### 1) Blue Water

When you shake the flask with colourless liquid, it turns blue. What happened?

by Mr. Rajendra Joshi (India)
Mr. Hassan Hameed (Maldives)
Mr. Budsurengiin Tumendemberel (Mongolia)



1)

STUDENT'S

BLUE WATER

Members Mr Rajendra, Mr Tumendemberel, Mr Ramesh
Mr Hameed, Mr Joshi

Look at the flask placed inside front of you. Note the colour of the liquid inside it. Now hold the flask as shown in the picture.

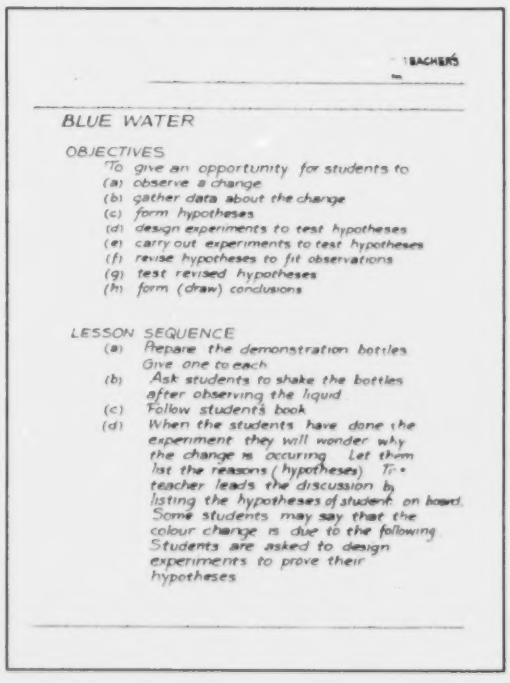
Shake the flask vigorously for about one minute. Hold the flask steady in front of your eyes. What do you observe?

What is the colour of the liquid in the flask immediately after you stop shaking it?

Is there any change in colour with time?
What is the colour of liquid after two minutes?
Repeat the experiment a number of times.

Make a list of all possible reasons to explain what you have observed.

How will you confirm which one of your guesses is correct? Design an experiment to test each of your guesses. Discuss your experiment with your teacher. Perform the experiments one by one.



TEACHER'S

BLUE WATER

OBJECTIVES

To give an opportunity for students to
(a) observe a change
(b) gather data about the change
(c) form hypotheses
(d) design experiments to test hypotheses
(e) carry out experiments to test hypotheses
(f) revise hypotheses to fit observations
(g) test revised hypotheses
(h) form (draw) conclusions

LESSON SEQUENCE

(a) Prepare the demonstration bottles. Give one to each.
(b) Ask students to shake the bottles after observing the liquid.
(c) Follow students' book.
(d) When the students have done the experiment they will wonder why the change is occuring. Let them list the reasons (hypotheses). The teacher leads the discussion by listing the hypotheses of students on board. Some students may say that the colour change is due to the following. Students are asked to design experiments to prove their hypotheses.





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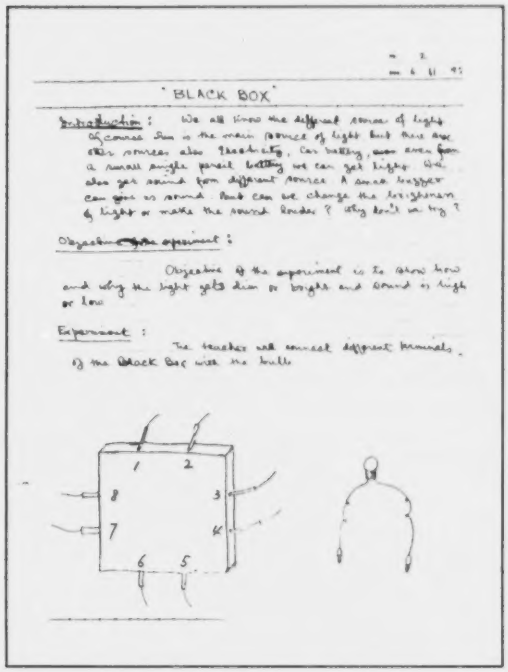
## 2. Black Box

Let us study how and why the light gets dim or bright with the black box with electric wires.

by Mr. Md. Nurunnabi Khandker (Bangladesh)
Mr. Tanding Wangyel (Bhutan)
Ms. Cai Mao (China)
Ms. Kim Yun-Hi (Rep. of Korea)



"BLACK BOX"

Introduction : We all know the different sources of light. Of course Sun is the main source of light but there are other sources also. Torch light, Car battery, even even from a small single pencil battery we can get light. We also get sound from different sources. A small knapper can give us sound. But can we change the brightness of light or make the sound louder ? why don't we try ?

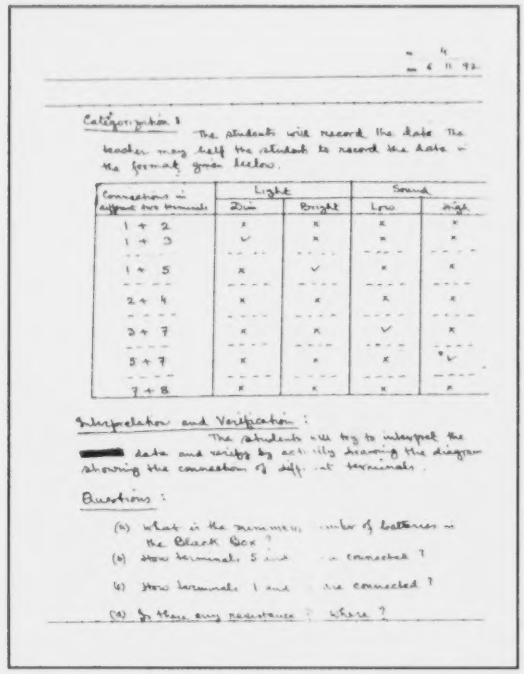
Objective of the experiment :

Objective of the experiment is to show how and why the light gets dim or bright and sound as high or low.

Experiment :

The teacher will connect different terminals of the Black Box with the bulb.



Categorization :

The students will record the data. The teacher may help the student to record the data in the format given below.

| Connections in different two terminals | Light | | Sound | |
|---|---|---|---|---|
| | Dim | Bright | Low | High |
| 1 + 2 | x | x | x | x |
| 1 + 3 | ✓ | x | x | x |
| 1 + 5 | x | ✓ | x | x |
| 2 + 4 | x | x | x | x |
| 2 + 7 | x | x | ✓ | x |
| 5 + 7 | x | x | x | ✓ |
| 7 + 8 | x | x | x | x |

Interpretation and Verification :

The students will try to interpret the [redacted] data and verify by actually drawing the diagram showing the connection of different terminals.

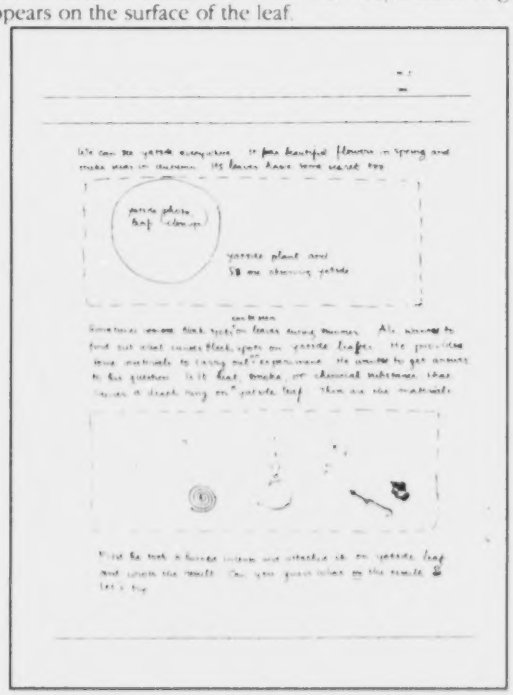
Questions :

(a) What is the minimum number of batteries in the Black Box ?
(b) How terminals 5 and [redacted] are connected ?
(c) How terminals 1 and [redacted] are connected ?
(d) Is there any resistance ? Where ?

## 3. Death Ring

When a leaf of Yatsude is burned with fire, a black ring appears on the surface of the leaf.

by Ms. Nuryani Y. Rustaman (Indonesia)
Ms. Nahid Farian (Iran)
Mr. Kim Joo-Hoon (Rep. of Korea)



We can see yatsude everywhere. It has beautiful flowers in spring and make nice in autumn. Its leaves have been used for

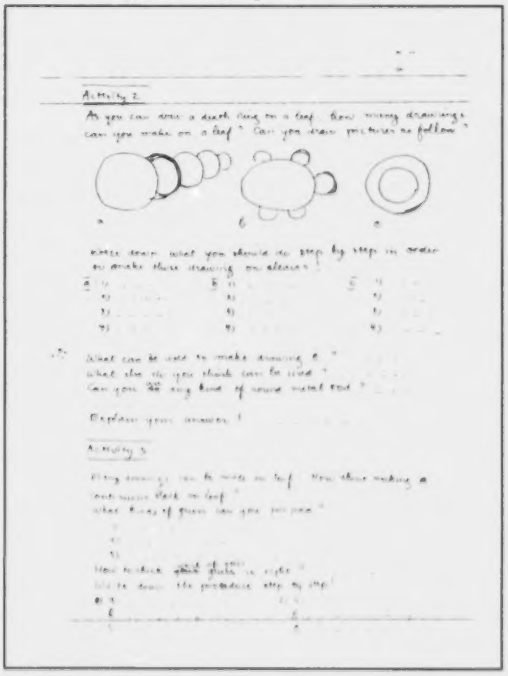



continue

Sometimes we see black spot on leaves during summer. All wanted to find out what causes black spots on yatsude leaves. We performed some materials to carry out experiment. We answer to get answer to the question. Is it leaf makes or chemical substance that causes a death ring on yatsude leaf. Then are the materials



First we took a leaves, cigarette and attached it on yatsude leaf and watch the result. Can you guess what is the result ? Let's try.



Activity 2

As you can see a death ring on a leaf. How many drawings can you make on a leaf ? Can you draw pictures as follow ?




Please draw what you should do step by step in order to make these drawing on a leaf.

a) 1) 2) 3) 4)
b) 1) 2) 3) 4)
c) 1) 2) 3) 4)

What can be used to make drawing a ?
What else do you think can be used ?
Can you see any kind of source metal rod ?

Explain your answer !

Activity 3

Ring drawings can be made on leaf. How about making a combination drawing on leaf ?
What kinds of flower can you see ?

1)
2)

How to make good flower in paper ?
Let's draw the procedure step by step !

a) 1)
2)
b) 1)
2)





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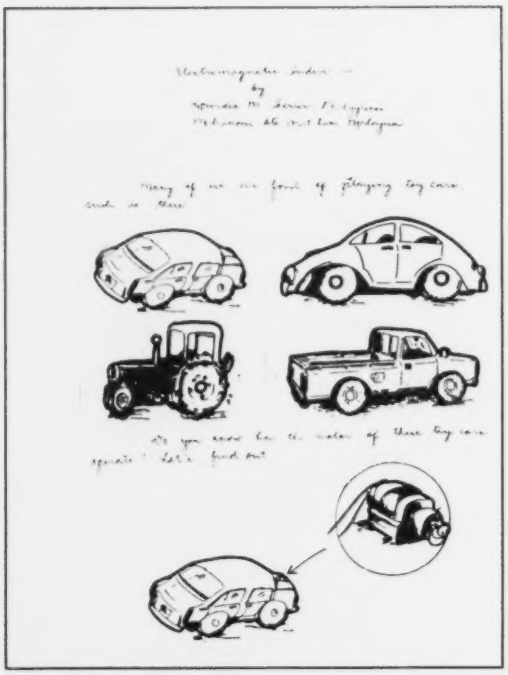
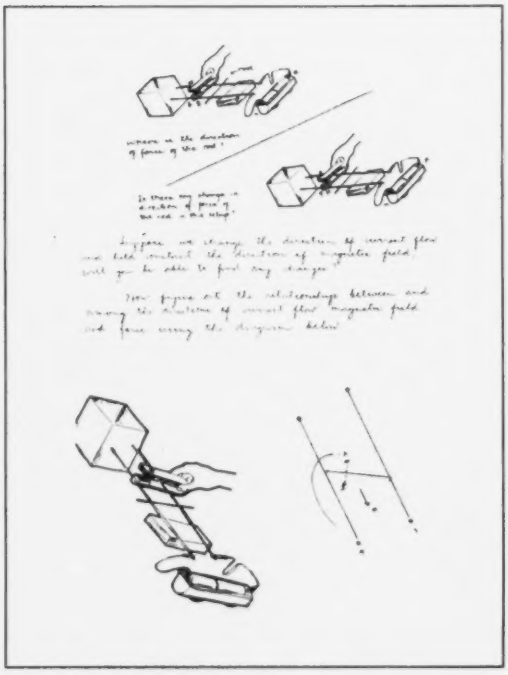
## 4. Electromagnetic Induction

Do you know how the motor of a toy car operates? Let us find out.

by Ms. Mahanom bte Mat Sam (Malaysia)
Ms. Lourdes M. Ferrer (Philippines)

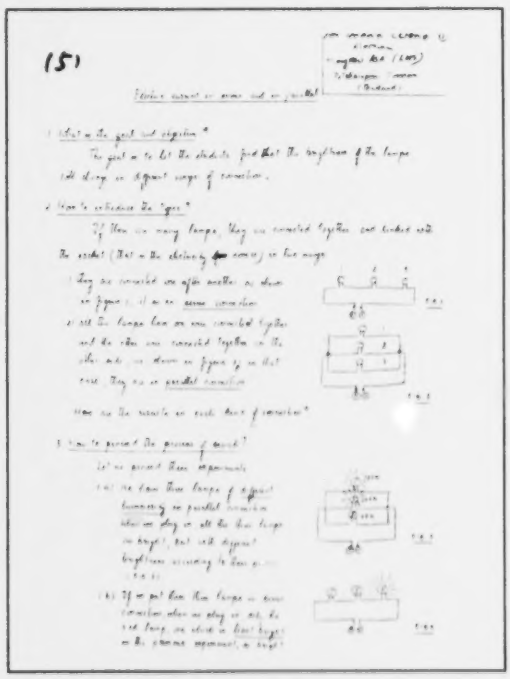


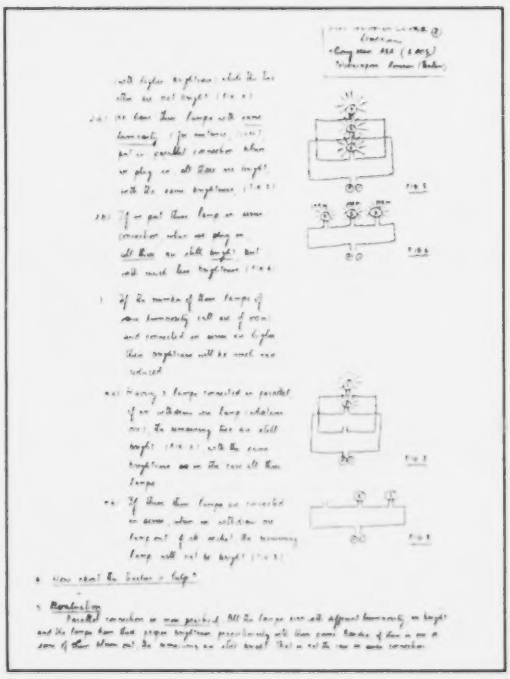


## 5. Electric Current in Series and in Parallel

Can we change the brightness of lamps by changing the connection ?

by Mr. Thongkeo Asa (Laos)
Ms. Petcharaporn Roenrom (Thailand)
Mr. Phi Hoang Cuong (Viet Nam)







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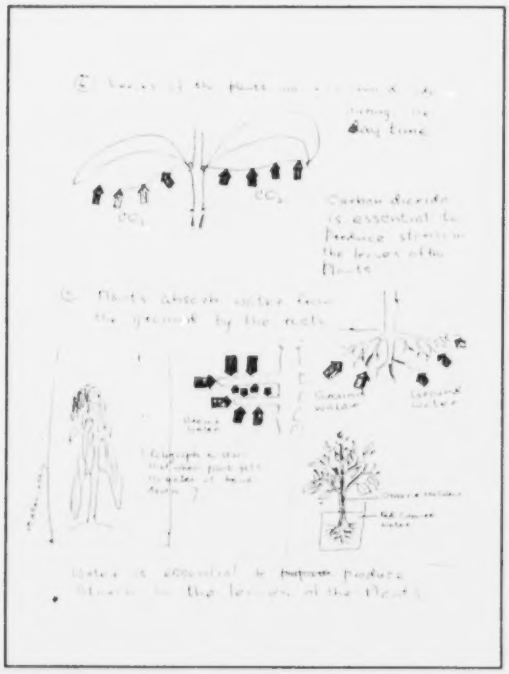
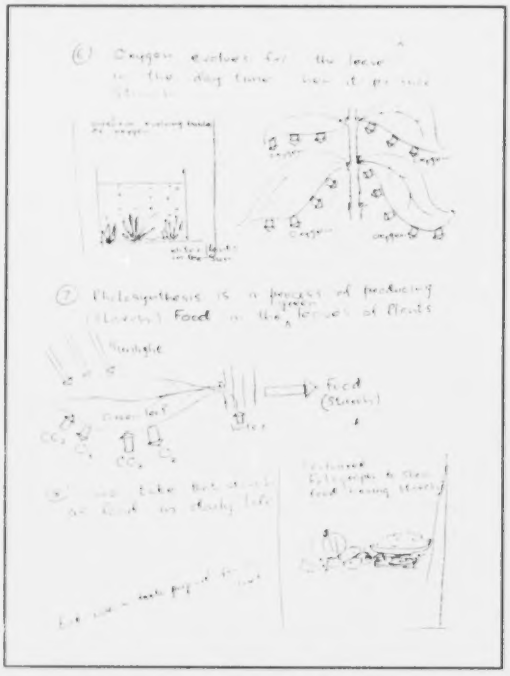
## 6. Photosynthesis

FInd out how plants make their food through experiments.

by Ms. Yu Yu Hlaing (Myanmar)
Ms. Rubina Nazli Goindi (Pakistan)
Mr. G.L. Wimaladasa Samarasinghe (Sri Lanka)
Ms. Edith Figueredo de Urrego (Colombia)
Mr. James Kinuthia Karaka (Kenya)

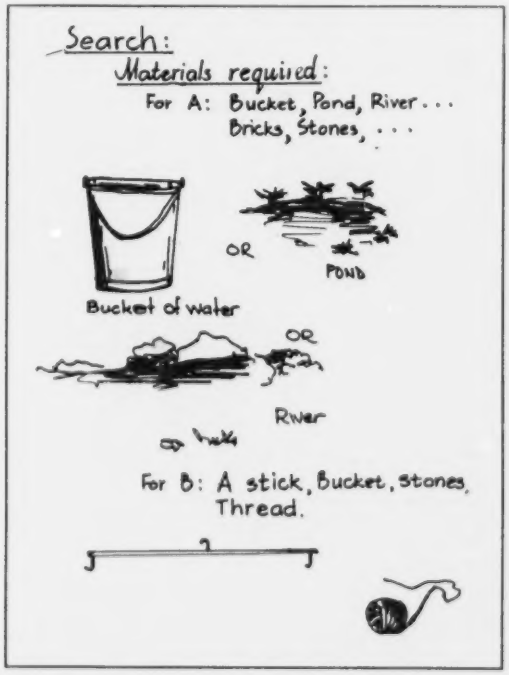


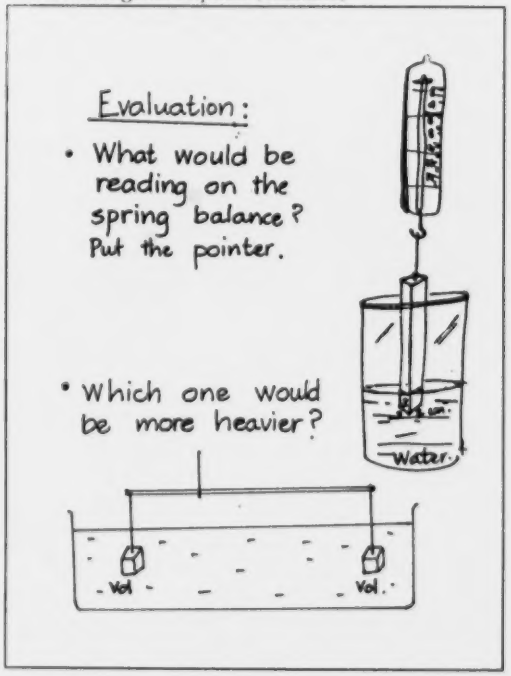


## 7. Archimedean Principle, Buoyancy

Weight of an object becomes less in water.

by Mr. Abd. Razak Abu Bakar (Malaysia)
Mr. Mohan Gopal Nyachhyon (Nepal)
Mr. Harold Ure (Papua New Guinea)
Mr. Phongchai Sriphan (Thailand)





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# PART II.

## Producing General Science Books for Children & Youths

# 1. Discovery of Wonders of Nature

Toshitaka Hidaka
Professor
Kyoto University, Zoology

## How the white cabbage butterfly can find a flower

In the past I have written only a few children's books but you will find a story of the cabbage white butterfly in an elementary textbook adapted from a film I made. Here I show how the butterfly can tell one flower from another. There is such a wide variety of flowers, some beautiful and some not, some large and some small. Now, how in fact could the butterfly amazingly finds its way to the right flower while it does not know that the flower plays a vital role in the higher plants' reproductive mechanism?

A flower can be different in shape, colour, nectar, and smell. Using a model shaped and coloured like a real flower, I discovered that the butterfly would approach it. I thought about just changing the shape and attached a square piece of coloured paper to a stick. Again the butterfly came around in search of nectar. Having no luck, it would depart, only to come around in search of nectar again and would keep repeating this procedure.

In other words, the cabbage white butterfly knows what a flower is not by smell, nectar, or shape, but by colour. On that assumption, I proceeded to find our what the butterfly's favourite colour could be. I used flower-like models which were red, yellow, blue, green, black and purple. As expected, black was out. Red did not work either because the butterfly cannot see this colour. It would approach the green flower; however it would not appear to be looking for nectar. In fact it thought the green to be a leaf and decided to rest instead. Purple was most popular, next came yellow, then blue. I believe the butterflies in Southeast Asia prefer yellow flowers and the butterfly in Europe favor blue flowers. This discovery captured the children's interest and they carried out similar experiments on their own. I wrote "the cabbage white butterfly likes the yellow flower most" in the school textbook. This prompted teachers to disagree with the expression "like" as it sounds non-scientific. I received many letters saying it should be put "yellow attracts the most". I rejected that, saying that it only makes it sound confusing to children, and people who do not see this are, in my view, being non-scientific.

## A butterfly "girl hunt"

I wrote a book geared towards middle-school teenagers that dealt with the question, "why does the butterfly fly?". Ever since I was a young child I would try to find out answers to these questions. In the field and ravine area by my house, the Swallowtail butterfly would always fly according to one fixed path. This pattern would not change no matter how strong the wind was. I was intrigued and was in fifth grade when I started to record the flight patterns of the butterfly during my summer holidays. Eventually war broke out bringing my records to a stop.

I was about twenty years old when once again I wanted to pursue my studies on the butterfly. I went to the mountainside. On a piece of paper I sketched a map and followed the butterfly's flight patterns by drawing in lines. By doing this I figured I could obtain the butterfly's flight pattern. However as time passed the 'Fly Way' would reveal an image which was out of line. When I went to check the following week the pattern made no sense. It was a very cloudy day. Then the next day was sunny and like my studies earlier the 'Fly Way' showed specific morning and afternoon light patterns. I found our that the sun played a major role. After various experiments I focused on the

Research on nature
turned out to be a lot of fun.

way morning sunlight penetrated the tree leaves making them glisten. It is here that the butterfly would fly. As afternoon approaches, the sun's rays hit another spot and still the butterfly flies in this area.

The reason why the butterfly flies in this manner can be explained by its diet. Ever since it was a larva it fed on the leaves of "sun trees" or simply, orange and mandarin orange tree leaves. This led me to understand that it would only be in this area that the butterfly could find a mate. How it actually accomplished finding one was the next question. After all the butterfly has no possession of a mirror and obviously would not know about its own appearance, let alone that of its mate. To "girl hunt" there must be some sort of 'bat signal' involved. I proceeded to find out what this signal was all about.

The Swallowtail Butterfly wings are basically all black covered in a yellow design. As I attached one butterfly wing to a board and placed it standing up, the male butterfly came by to investigate. Therefore it became clear that the butterfly regarded wings as some sort of signal. In order to find out what distinguished the wing as wing I tried colouring in the yellow design covering the wing to red and blue, only to discover that the male did not even approach the wing. So the yellow attracts the butterfly to the wing, fine, but why are the wings coloured black? In South America there are butterflies that tare brown and red. In one experiment based on another source, the wing that was coloured entirely red was especially successful in attracting the male butterfly. However if the red wing caught the attention of the butterfly, it could do the same for the enemy. It was thought therefore that this explained the reason for the brown colouring which acted as a camouflage.

I figured the case must be the same for the Swallowtail Butterfly so why not come up with the ideal female butterfly? From the yellow part of the wing, I cut out shapes of butterfly which, sure enough, stood out. The male butterfly would only take notice and would fly away. There has to also be a black design. I don't know if this is for sure but males in general are said to be theoretical. If this is true then we should put this into account for the male butterfly that assumes a good find comes in stripes. The silly butterfly was attracted to even a piece of paper as long as it was stripe black and yellow. In other words, the male Swallowtail Butterfly has only an idea of what it think a female butterfly to be. That was the conclusion of my book which the middle school students found extremely amusing. I was given the Mainichi Shuppan Culture Award.

**Why is basic research omitted from being in textbooks?**

In earlier days this sort of basic research was not looked upon fondly. The question of how a male butterfly found a female butterfly was not considered something to experiment on, but rather a hobby. Now, times have changed as research finds answers to simple questions we all have. It is questions such as these which make lines in the newspapers, followed by a request for writing a book from a publisher. I wrote an book called "The Flying Path Way for A Butterfly" which was published not in a science textbook, but in a Japanese language one.

One would never find research as original as this in a science textbook used in Japan. The reason is because even if one studies this material it would not e of use to get into a university. All textbooks used in Japan are a preparation towards the entrance for university, this being my reason for disliking producing textbooks. It is the case that in Japan textbook guidelines are determined by the Japanese Ministry of Education and an editing conference is held according to these regulations. First university professors come up with the draft for the textbook. At this stage rather new and interesting findings are written. However as the draft is passed on to be read by high school teachers, recent findings are looked upon as 'not possible to reach in the classroom' and are omitted. They settle for textbooks with material taught in classrooms thirty years ago. That is why these textbooks are not the least bit interesting. This presents a serious problem.

**"Fabre's Insect Diary"**

It was the Fabre's Insect Diary that gave me the inspiration to become an animal researcher. When reading this book, one can see the extraordinary things insect do. When I read of how when a bee caught a bug to feed on it wouldn't kill the prey entirely but rather paralyze it, I would not believe it. I thought that it would be impossible especially for a bug. However when I saw what I saw in the field, the bees were doing just this. This whole thing was such an amazement to me that I decided from then on to be an animal researcher. That was when I was in third grade in elementary school.

Fabre's Insect Diary was indeed very intriguing. I read various other books but none came close to being as interesting as Fabre. Fabre's Insect Diary was something written in his own words from what Fabre himself saw with his own eyes. This drew the reader into the story completely. If written objectively, it would only be a bore. There is also Fabre's Plant Diary for children which I find rather dull because it is so obvious they are being taught. I have decided that whenever I write a book it would be in my own words, with my own feelings expressed and never for the purpose of educating someone.

In the postscript for the book, "Why the Butterfly Fly", I wrote that when it comes to scientific books if is often the case that such an experiment resulted in such and such results, commending for further successful advancement in the field of science. In this respect, science, I think, is about doing the ridiculous or the useless. And making guesses like "its probable" or "it can be possible that" turned out to be a lot of fun. Another book I wrote for middle grade teenagers was called "Do Mice Go Around The Globe?". It was just one of many things that were unknown and were left unanswered. I was told I cannot write of unknown things in a scientific book. Bur there is no such thing. A book full of unknown things should be allowed to be there. Although the book had a bad reputation among some readers, the majority of readers found it an interesting book to read.

After going through all this, I am beginning to have an idea of how a book about science should be written. I am told by young science researchers, teachers, and students that their minds have been stimulated after reading my books. I have received many letters from my readers which tell of how they were inspired, and of how they have become interested in ethology. I presume that my books have had some impact on the readers.

## 2. Fun & Games & Science & Literature & Education

Vicki Cobb
Writer for Science Books for Children

So are you having fun yet? Remember when you were a kid, having fun was a priority. If you were like me, you'd brainstorm with your friends to decide what to do with an afternoon. Everyone would make suggestions: "How about playing house? or store? or cowboys and Indians?" or "Let's ride bikes, or roller skate?" No one ever said, "How about reading our science textbook?" Suggestions were usually greeted with one of two editorial comments, "No, that's not fun" or "Yeah, that sounds like fun."

How many of you make a point to have fun every day? According to the dictionary, fun is a source of pleasure and enjoyment. It is a very important word. It is in a lot of book titles: My local library had a listing of 1,009 titles that had the word fun in them. *Fun with science; science can be fun; fun on four wheels; grammar can be fun; big fun to grow book; city fun, maps and globes: fun facts and activities; the great American depression book of fun* --- to name a few.

When I was a kid, I remember thinking that the word "fun" in a book title was suspect. It smacked of hard sell even when you knew the book was going to be fun. One book I remember quite well was an activity book for when you were sick. It contained puzzles, games, things to make. The title was "Junior Fun in Bed". It seemed odd to me that they stuck in the work "Junior" which wasn't all that common, even in those days. Why didn't they just call it "Fun in Bed"? I was eight or nine at the time and in those days childhood was definitely more innocent.

The connotation of the word "fun" is more often than not a judgment call. Kids are told so often that they should do something because it will be fun. Mark Twain's wonderful character, Tom Sawyer, charmed friends into do painting a fence by making them think it was a lot of fun. The paint he used was called "white wash." The American expression "white washing," which means to con people into doing something they don't really want to do, came from this book. As a child, I remember grownups saying, "We're going to a concert, it will be fun" or "We're going to a museum, you'll like it, it's a fun place." I was about ten when I had the thought, "What's the matter with these grownups? They say they were once kinds. Don't they remember what's fund to a kid? It's hard to believe they do, if they think a concert or a museum is fun. I think they're boring." At that moment I vowed that I would never forget what it's like to be a kid, no matter how old I got. Make no mistake, kids are authorities on fun. They know it when they're having it.

Play is a child's work. Play is the reinvention of reality, a suspension of the rules. It is trying things out, just for fun. It is the freedom to take risks with the full knowledge that you could make a mistake, even worse, make a fool of yourself. It is juxtaposing something familiar against an unfamiliar background or vice versa. Science writer, K.C. Cole wrote a marvelous newspaper piece several years ago showing how great scientists don't forget how to play. She wrote:

*"Sir Alexander Fleming, the Scottish bacteriologist (1881-1955), had a most peculiar pastime. He liked to paint pictures in petri dishes with a palette of living germs. Being thoroughly familiar with microorganisms --- their individual colors, texture, growth rates and so forth --- he was able to produce striking portraits: a mother and child, a ballerina, his house.*

*"Fleming is far better known for his breakthrough discovery of penicillin than for this micro organic art. But he was clearly a man who knew how to play. 'I play with microbes,' he once said of his work. 'It is very pleasant to break the rules.'"*

I bring up this idea of play in work because for a long time, as a writer, I wasn't playful at all. It didn't occur to me that I could be. After all, science, the subject I wrote about, was serious stuff.

I became a science writer when I got pregnant and could no longer teach. I figured if I could talk about science, I could write about it. My first writing job, in 1964, was to create a high school chemistry text something like Cliff Notes. The man who hired me knew only one thing --- it had to

"Science can be fun"

sound simple. His logo was "Simplicity is Worth Millions" which obviously was wishful thinking since his Brooklyn storefront operation clearly was not worth anything close. After interviewing me, he commented, "Well ... You sound intelligent even if you are pregnant." And he gave me the opportunity to write a chapter on speculation but it had to be simple. After three submissions, when I was told my efforts were not simple enough, I finally won a contract. It was work-for-hire, my name was not going to be on the book, but I had found interesting work I could do at home to make money, while I was being a mom.

I finished that chemistry book. I wrote it as I thought you were supposed to write, dispassionately, straightforwardly, impersonally. The thinking behind so-called informational writing was that distancing oneself from the reader gave the work authority and objectivity. At all times, one had to be aware that one was writing the Truth with a capital T. My writing was clear, simple, and incredibly boring. Not to worry, it wasn't published. When I asked why, my editor accused me of plagiarizing --- he had interviewed another would be writer and had shown this person my manuscript asking for his opinion. The candidate wanted to make an impression, to show how knowledgeable he was. He pointed to the sentence, "Carbon has a valence of four" and claimed he had seen that exact sentence in another book.

Naturally I was disappointed. However, that chemistry book was a start. I learned I could write something book length just by writing page after page for a long enough period of time. I searched for other work. I wrote a curriculum for a job-corps training center. I wrote two high school texts: Molecular Biology and Biological Measurement that weren't published because the publisher went bankrupt.

In the process of networking --- calling everyone I knew to find out where I might get writing assignments --- I finally called an editor at Franklin Watts Publishing Company. We made a date for lunch and he asked that I bring samples of my writing. I went to my appointment loaded down with my three unpublished manuscripts. He glanced briefly at the pile of pages and said, "Vicki, you have to write a book for us. How about THE FIRST BOOK OF LOGIC?" Since I had had one semester of logic in college and it wasn't a completely foreign subject to me, I agreed. "You give us an outline, we'll give you a contract," he said. When he asked how long before he received the contract I said six weeks. I figured in six weeks I could learn enough to write an outline, after that I'd worry about writing the book. THE FIRST BOOK OF LOGIC was published in 1969, five years after the chemistry script.

Now I would like to dwell on the idea of a game. Kids play invented games as well as traditional ones. According to the dictionary the first definition of a game is, "a way of amusing oneself; a pastime; diversion." The second definition is: "Mathematics. A set of rules completely specifying a competition, including the permissible actions of and information available to each participant, the probabilities with which chance events may occur,

the criteria for termination of the competition and the distribution of payoffs. In other words a game is a paradigm, a setting of parameters within which certain behaviors are predictable, permissible, even desirable.

There are two important points about games. First, they are invented. Human minds create them. Their source is imagination. The importance of events defined by a game are only significant within the context of the game. Sometimes we forget this. A man running 90 yards with an oval shaped object tucked under his arm has no significance unless he is in a stadium with 80,000 screaming people and eleven oddly dressed men trying to stop him. Some Brooklyn Dodger fans actually committed suicide in 1951 after Bobby Thompson hit that ninth-inning home run and the Giants won their league and could go on to play in the World Series. Sports in America can seem to be a life and death event. For these suicides, it was too late to remind them that it was only a game.

Secondly, games are useful because they create and allow for possibilities that are outside what we know to be reality. This planet has advanced because there were some daring souls who made suggestions, just as possibilities, that flew in the face of what everyone knew was the harsh Truth of reality. And guess what, their possibilities actually became realities. It is entirely likely that we limit ourselves in speaking what's possible because of what we say we absolutely know is true. Here is a list of Known Facts that were stated by some distinguished people: In 1899, Charles H. Duell, Director of the U.S. Patent Office said, "Everything that can be invented has been invented." In 1927 Harry M. Warner, President of Warner Brothers Pictures said, "Who the hell wants to hear actors talk?" In 1918, President Grover Cleveland said, "Sensible and responsible women do not want to vote." In 1928, Robert Milliken, who won the Nobel Prize for discovering the magnitude of the charge of the electron, said, "There is no likelihood that man can ever tap the power of the atom." In 1895, Lord Kelvin, President of the Royal Society and the man who proposed that -273 degrees Celsius be absolute zero, categorically stated that "Heavier than air flying machines are impossible."

One of the things that drives human beings is the need to know what's real. Inquiries into the nature of reality has been a favorite conversation of philosophers. Is reality what you perceive or is it what you define? In fact, as long as you know how you define reality, in other words, if there is an awareness of the paradigm you are using, reality is your definition.

Believe it or not, science is just a game. We observe what happens in nature. Then we try to invent the rules that could explain what we observe. There is nothing new in inventing explanations. The Aztecs, who were the first to grow popcorn, believed that the reason popcorn popped was that the little demon who lived in each kernel of corn became so enraged when his house was heated that he had a temper tantrum and exploded. This is a perfectly good explanation, except you can't do anything because of it. It goes nowhere. It has no power.

A scientific explanation is different. The word "science" means "to know." A scientific explanation is built step by step by careful observation and replicable empirical evidence. The scientific explanation of why popcorn pops is that the water inside each kernel changes to steam when heated. The seed coat contains the steam, keeping most of it from escaping. The pressure builds, according to the gas laws, until the temperature reaches 175°c the pressure is 9 atmospheres, about 135 pounds psi. At this point skin ruptures and the starch inside the seed expands and becomes gelatinized.

The rules of the science game are great generalizations that stem from induction, going from the specific to the general. Once formulated, they become a basis for deduction, for further explanation and, most importantly, for application --- new things, technology is now possible. Science is powerful because of what it allows us to create not because of what it explains. This power to create, to build a technology, seduces us into thinking that the rules of science are Truth with a capital T. They are not. They are simply rules we have invented. Consider this quotation:

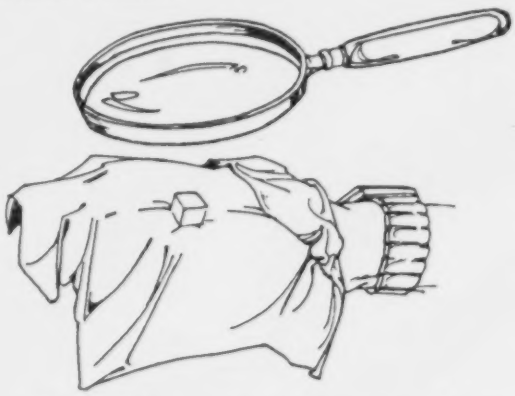
*"Physical concepts are the creations of the human mind, and are not, however it may seem, determined by the external world. In our endeavor to understand reality we are somewhat like a man trying to understand the mechanism of a closed watch. He can see the hands move and hear its ticking but he has no way of opening the case. If he is ingenious, he may form some picture of a mechanism which could be responsible for all the things he observes but he will never be quite sure his picture is the only one which could explain his observation. He will never be able to compare his pictures with the real mechanism and he cannot even imagine the possibility of the meaning of such a comparison." Albert Einstein* (1938).

Children understand fun and games. They are authorities on play. Fun, play, and games are crucial to the development of science and what do

**The Incredible Shrinking Cube**

Hold a sugar cube in your hand, close your eyes, and the sugar cube suddenly feels smaller.

You'll need a magnifying glass, a handkerchief, and sugar cube, die, or other small cube. Hold the cube with the handkerchief covering your hand. (The handkerchief prevents you from seeing your hand, which is itself a clue to the size of things.) Feel the cube through the cloth while looking at it under the magnifying glass for several minutes. Then close your eyes and just feel the cube. Incredibly, it shrinks!



Vision is our dominant sense. When we get conflicting information from touch and vision, we perceive what we see, not what we feel. A cube through a magnifying glass looks larger than it really is, and you feel it as the size you see it. When you remove vision and only receive information through touch, you perceive the size of the cube as it really is.

*From "How to Really Fool Yourself"*

we do? For the most part, we teach science so that it isn't fun, has no play value, and is serious, fact laden stuff that has nothing to do with anything quite so frivolous as a game. As science educators try to seduce children (and teachers) into the world of science by telling them, "It will be fun." We invite them to enter the world of science. Perhaps we are doing it backwards. Just for fun, think of it this way. Instead of bringing children into the world of science, what if we bring science into the world of children?

What is the world of children? One way to know it is to get back in touch with the child you once were. Children are first and foremost human beings ... really. So they are turned on or motivated by the same kinds of things all human beings are motivated by but with a slightly different context than adults. As a children's book author I have the same problem as teachers. I have to "hook" my readers just as teachers have to "motivate" students. I've invented a few rule for motivating kids which I'll share with you. They are not the Truth and this is not science. Trust your experience as a human being to give you a gut-level evaluation of these rules and see if they work for you. Okay, so this is Cobb's list of what turns kids on. But first, be aware that they are not equal to each other in emotional charge. Different kids will respond differently to them, depending on their own backgrounds. There are six items on the list, excluding sex, which is off limits in most cultures.

1. What kinds already know of life. Here you have to make certain assumptions about children's daily lives. If kids live close to the land, they will understand certain aspects of the natural world. If kids live in a modern urban society, they will understand certain consumer goods --- school supplies or cosmetics. This category has the widest base and probably the least emotional import. It is a fallback in case you can't figure out a way to use one of the next five items.

2. Food. All kids like to eat and will be interested in a subject if food is connected to it.

3. Empowerment --- anything that makes a kid one-up on someone else. Children understand that they are dependent on adults and that they have very little real power. They are empowered by their ability to handle yuck and go, they delight in performing magic or pulling a trick on another.

4. A sense of wonder --- For children this is not the mystical or spiritual. It is the Guinness book of world records --- the biggest, the fastest, the top superlatives.

5. Any threat to life. Children are dealing with the idea of their own mortality. I remember thinking when I was a child that somehow I would not die. I would figure out a way to be different from others. Kids work out threats to life with fairy tails. In science it explains why they love dinosaurs. Dinosaurs are made up of tow motivators - they were very, very big and they are very, very dead - an unbeatable combination.

6. Absurdity that creates intrigue--odd acts juxtaposed against an unusual context. For example, I love it when someone calls me up and asks, "What are you doing, Vicki?" I delight in answering, "I'm cooking apples in cleaning solution, or hanging strips of paper in the shower, or tearing apart disposable diapers, or smearing cold cream on gelatin." I hope they wonder why would a sane person do such things? This could start them thinking, luring them into wanting to learn the answer ---- an invitation into science.

In my work, I've been getting increasingly outrageous in entering the world of children. Two current works in progress are manuscripts that are concerned with technology and physical science.

Squirts and Spurts which my publisher wants to call Playing with Water. The opening sentence is "How many different ways can you squirt water out of your mouth. don't just think about it, experiment and find out."

Bangs and Twangs which my publisher wants to call Playing with Sound. The opening sentence reads "How many different ways can you make sounds with your body without using your voice." I've invented a character to run around the pages making comments to the reader in speech "bubbles" comic book style. This character says to the reader, "Remember, not all sounds are polite."

My writing is becoming more personal. I don't use the editorial "we" which is distancing. I say "I" (very sparingly, by the way) instead of "we" except when I have a coauthor. In the ms I just finished writing with my coauthor, Kathy Darling entitled **Wanna Bet!** the opening reads as follows:

*A WINNING STREAK*

*Wanna bet you can't do any trick in this book without trying another. These tricks look like long shots but they're not. We've fixed them so that no matter how impossible they seem, you always come out on top. No question about it, winning is fun.*

Creating this book was fun, too. Kathy came over to Vicki's house to play. We played with TV clickers. We blew bubbles, sent each other secret messages, stabbed balloons, made nutty putty, tied bones in knots, ripped apart disposable diapers, cut up rubber balls, munched Lifesavers and set nuts on fire. We laughed a lot. No doubt other grownups would think we were weird. Too bad for them. We know fun when we're having it. We figure you do, too."

I am not the only writer of science for children who brings a strong voice to their work. I'd like to share with you the opening paragraphs two of my distinguished colleagues. Notice how both use the threat to life theme to hook their readers.

Pat Lauber: "Tales Mummies Tell"

*"One long-ago summer's day, a baby woolly mammoth somehow lost his mother. He was no more than seven or eight months old, so young that he had only milk teeth and still depended on his mother for food. As he wandered around his home range, near the Arctic Circle, his body fat was quickly used up. Frantic with hunger, he tried to eat dirt and plants. Then he had an accident and fell, perhaps into an icy pit, where he soon died. In the far north, summer is short. The body froze and became encased in ice. Cave-ins buried it under six feet of earth. The ground froze and stayed frozen, except for the top few inches, which thawed each summer. In this natural deep freeze, the body of the baby mammoth was preserved for thousands of years. It became a mummy, which is the term now used for any wee-preserved body, whether animal or human."*

Jean Craighead George: "A Day on the Alpine Tundra":

*"An hour after sunrise on August 16th, a huge slab of rock slipped. It lay at 10,000 feet on the top of Rendezvous Mountain in the Teton Mountains of Wyoming. It had been cracking in the heat and cold for centuries, an not on August 16th at 7:20 a.m. was poised to fall.*

*"A snowfall, a wind blast of more than 30 miles per hour, even the vibrations from a thunderclap, would be all that was needed to send the monolith crashing five hundred feet onto the alpine tundra.*

*"Below, on the fall line of the slab of rock, Johnny Moore was sleeping in his mountain tent in the grass of a meadow.*

*"The wind blew softly. A mountain top is a land of great peace or great violence."*

What has emerged from all of our writing is a children's science literature. By literature, I mean the single, passionate voice. By passionate, I mean that the individual brings his or her own self-expression to their work. The writer reveals through the work the kind of person he or she is. And it is this revealed humanity that touches us in all great literature. Shared humanity is the common denominator of all authentic communication. The degree to which you bring your own humanity to your work will largely determine your effectiveness. How passionate you are in your activities will determine the difference you make in the lives of students, not the particular content of your work. If you think about the great teachers who made a difference in your life, I would wager that you remember nothing of substance that they taught. What you remember is how they made you feel, about yourself and about certain subjects. If something turns you on, if it touches the child you once were, it will touch your readers. Trust me.

**Glued to Your Chair?**

Bet you can't get up from a chair! No gimmicks! No strings either!

THE SETUP: All you have to do is get up from a chair. Sit in a straight-backed armless chair. Keep your back against the back of the chair and put your feet flat on the floor. Fold your arms across your chest. Now, keeping your feet flat and your back straight, try to stand up.

THE FIX: We lied about the gimmick. The gimmick is gravity. In the string position the center of gravity is at the base of your spine. By trying to stand up with your back straight, you prevent the center of gravity from moving to a position above the feet, which are your support base. Human thigh muscles simply aren't strong enough to compensate for the balance problems during the getting-up period. So you remain glued to your chair.

*from "How to Really Fool Yourself"*

I went to an extraordinary elementary school from kindergarten through the "eleven's" which was what we called sixth grade. There were no grades, only written reports to our parents on individual progress. I have come to realize that what I do as an adult is to create sixth grade for myself. I loved it that much. In that year I was challenged, and thoroughly engaged in all kinds of intellectual and creative activities. In my writing I still can experience things and change those experience into creative works that other children can enjoy. My style --- my voice --- is who I am --- the same person you see here. It took years to discover it, believe in it and communicate it effectively. If you wish to reach readers you must discover your own special voice the one you use when you speak that you know people listen to No easy task.

The word "education" comes from two Latin words meaning "to lead out." To me, education means to give children the tools so they are prepared to continue to lead themselves out in an increasingly complex society. Facts are the least of what children will need to know. In the future, people will have portable electronic notebooks that connect to a databases that will give more information than perhaps you ever thought you wanted to know. Children will need to know how to ask the kinds of questions that can access information. They will need conceptual frameworks of big ideas that serve as road map for the specific information they seek.

You, their educators, must be role models for a life of ongoing inquiry. Let them know who you are, what your passions are, indeed that it's okay to have passions. From you they can learn that it's okay to make mistakes; that it's okay to have fun while learning; that it's okay not to know answers; rather that it's more important to continue to ask questions. It's okay to sometimes be silly, or playful, or very serious and committed.

If you are not fully self-expressed in your work, it might be helpful to ask what stops you from bringing your passions to your work? Is it what you already know is true? Is it resignation? Is it cynicism? Is it laziness? Do you communicate these the attitudes to your students?

I want to close with a quote from Rachel Carson, a visionary for the future of our planet, its environment, and its children. She said, in her book "The Sense of Wonder":

*"It is not half so important to know as to feed. If facts are the seeds that later produce knowledge and wisdom, then the emotions and the impressions of the senses are the fertile soil in which the seeds must grow. The years of early childhood are the time to prepare the soil. Once the emotions have been aroused --- a sense of the beautiful, the excitement of the new and unknown, a feeling of sympathy, pity, admiration, or love --- then we wish for knowledge about the object of our emotional response. Once found, it has lasting meaning. It is more important to pave the way for the child to want to know than to put him on a diet of facts he is not ready to assimilate."*

What if we all brought fun and games to science education? What if we made our science books truly human? What would these possibilities create? We could experiment and find out.

## 3. My Experience on Writing Science Books for Children

Takahisa Hanya
Emeritus Professor
Tokyo Metropolitan University

### An attitude about science, in writing science books for children

Reevaluation of science

I admit the fact that the development of science has been a wealth to human society and believe that it should keep developing. However, in times of population explosion, increase in north-south differences, and increasing environmental problems, we urgently need to reevaluate the direction of the development of science as it has been. For example, A chemical compound which is ideal for production , such as halo-carbon or insecticide DDT, may be harmful to the environment. Also, there are tragic cases where doctors as well as competent scientists became oppressors of the weak of the society through the misuse of scientific logic. In the case of Minamata Disease, which is a disease caused by the polluted water, some patients were not acknowledged as victims of Minamata disease. There is a great possibility of such a misuse of science in the Asian countries, too. This reevaluation of science should be reflected in children's books as well.

The modern western world has so far been a production-oriented society, with its greatest emphasis on economic development. If the character of science were to be divided into philosophy-oriented, production-oriented, and environment-oriented categories, the present form of science has too much of a production-oriented character. In the future, the balance of all three needs to be considered.

Unless proven, no action - that is the logic of production-oriented science. On the other hand, according to the environment-oriented scientific logic, action should be taken when a hypothesis is set even if it is not proved. It is too late when the hypothesis is proved, as illustrated by the fact that the scientists had been warning about global warming for over forty years. The warnings by the scientists about the dangers of chemical compounds are also not heeded adequately in modern society.

Scientific issues in future that society will be asking about

Traditional science has tended to observe nature as a resource for the development of human society. Today, it will be necessary to research how much the individual factors of nature are intertwined with human survival. These points should be considered;

- How do human's activities change nature?
- The relationship between social norms, values, and human activities
- The relationship between the past, present and the future.

### What do we tell the children?

It seems that children are far smarter than I thought they would be, though their knowledge is sparse compared to that of an adult. They might be able to absorb quite a difficult idea if the idea is described in easily understandable way.

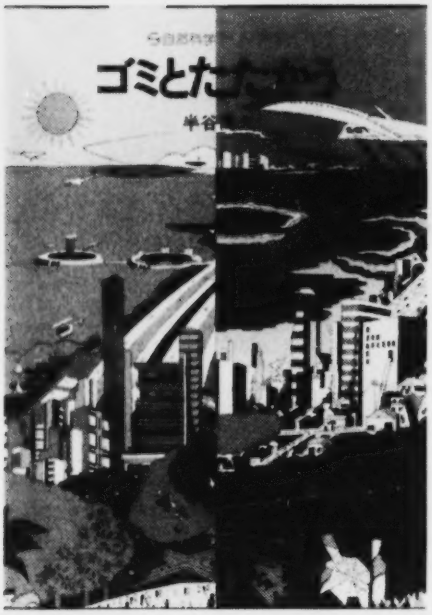
The writer's idea

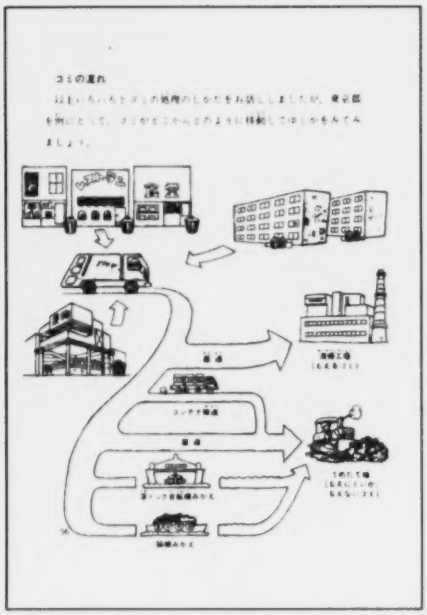
By creating a flow of ideas in the description of the book, the writer can express a systematic approach to knowledge. The main points which I want to emphasize are;

- To look at things historically (chronologically) - the present is formed by the past and the future is created through the present.
- There are different values of right and wrong, and good and evil cannot easily be distinguished, as water is a friend to humans, but at the same time an enemy.
- How to make science beneficent

The basis for the scientific way of thinking also should be told to the children. That is;

- Discovering a phenomenon and describing it.
- Experiential causalities
- Understanding logical causalities --- the importance of interpretation through hypothesis, developing of hypothesis and





"Fiting Against Garbage" written by Dr. Hanya, and edited by Mr. Itoh

inspiration
- Proof through experiments and observation. Do not be afraid of trying out new things and thereby making errors or wasting time
- Interpretation and logic will be rewritten as time goes by.
- One cannot do research if he/she does not like it.

Advise on selecting topics

Make the close link with the children's life. Unless closely linked with a region, social problems, something that the children may easily gain access to, experience of playing, life, it will only be a list of items of knowledge and the way of thinking scientifically cannot be developed.

It is also good to talk about dreams of science to imagine things. If science evolves, imagination will expand. Also, the topics should be those on which the writer can express his/her ideas.

Technical advice on writing

- Discuss with the editor before and during the drafting. Pass on the writer's ideas to the person in charge of the illustrations.
- Make it clear which points to emphasize
- Create a set flow of ideas
- Create a syllabus and revise it even while writing.
- Collect topics at random and then select them. Do not be afraid of collecting any extra information. It is difficult to fit in the flow of ideas, create a marginal box within the text.
- Using the stories of scientists or discovery stories, illustrate scientific thinking. Stories on trial and error are especially important.
- Explain about the evolution of science through its history.
- Bring in examples of how science is beneficial.
- Utilize technology of hardware, such as cards or personal computers.

**Supplementary comments by Mr. Saki Itoh,**
Editor, Komine Shoten Publishing House

It was rarely that scientists wrote science books for children in Japan about 15 years ago. At that time, I met Mr. Hanya, to ask him to write a children's book about water. I, myself, am not an expert on science, however, I could ask Mr. Hanya questions from the viewpoint of children. That book was highly appreciated because science books which dealt with social problems were very rare at that time.

It is very important that the editor, who is the first reader of the book, read the text and then ask questions and discuss with the writer from the viewpoint of children. I participated in experiments so that I can have the same experience. I have also been trying to utilize illustrations or photos to convey the writer's ideas to children in an easily understandable way. Good scientists are not always good writers for children, but they know how interesting it is to study science. It is my pleasure as an editor, to tell children that there are a lot of interesting studies and a lot of ways of thinking in the world.



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## 4. Producing Science Books for Children & Youths (Practical Session)

conducted by Vicki Cobb
Takahisa Hanya

### Group-A "Science Experiments You Can Eat"

conducted by Ms. Vicki Cobb

Ms. Cobb wrote many science books for children introducing many interesting experiments they can do with familiar foods. For most of the participants, it was the first experience of producing such kind of science books. So in this session, much time was devoted to discussions including brain-storming and experience-sharing. They worked in 2-3 member groups, so that they could discuss and evaluate the work in the group.

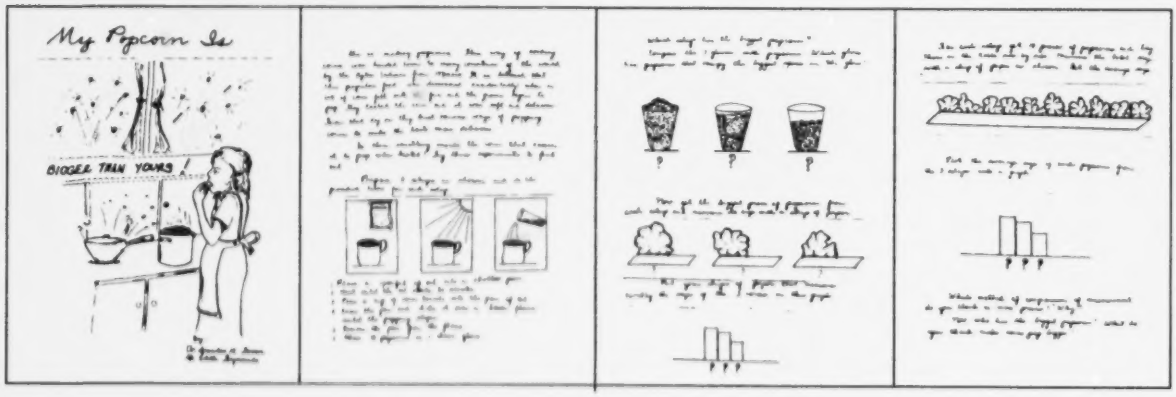
On the first day, the participants tried to do various experiments that children can do by themselves with familiar food whereby they can learn a scientific principle in an interesting way. There was also an interesting experiment with ice cream, in which the participants tasted several kinds of ice cream and guessed the contents of the ice cream or what kind of additives it contained.

The participants finally produced science books on various foods, discussing what kind of expression is most understandable, or what kind of presentation of texts and illustrations is most efficient for children.

Members of Group-A

Mr. Md. Nurunnabi Khandker (Bangladesh)
Ms. Cai Mao (China)
Mr. Hassan Hameed (Maldives)
Ms. Yu Yu Hlaing (Myanmar)
Ms. Rubina Nazli Goindi (Pakistan)
Mr. Harold Ure (Papua New Guinea)
Ms. Lourdes M. Ferrer (Philippines)
Ms. Petcharaporn Renrom (Thailand)
Ms. Edith Figueredo de Urrego (Colombia)
Mr. James Kinuthia Karaka (Kenya)

Ms. Lourdes M. Ferrer (Philippines) Ms. Edith Figueredo de Urrego (Colombia)



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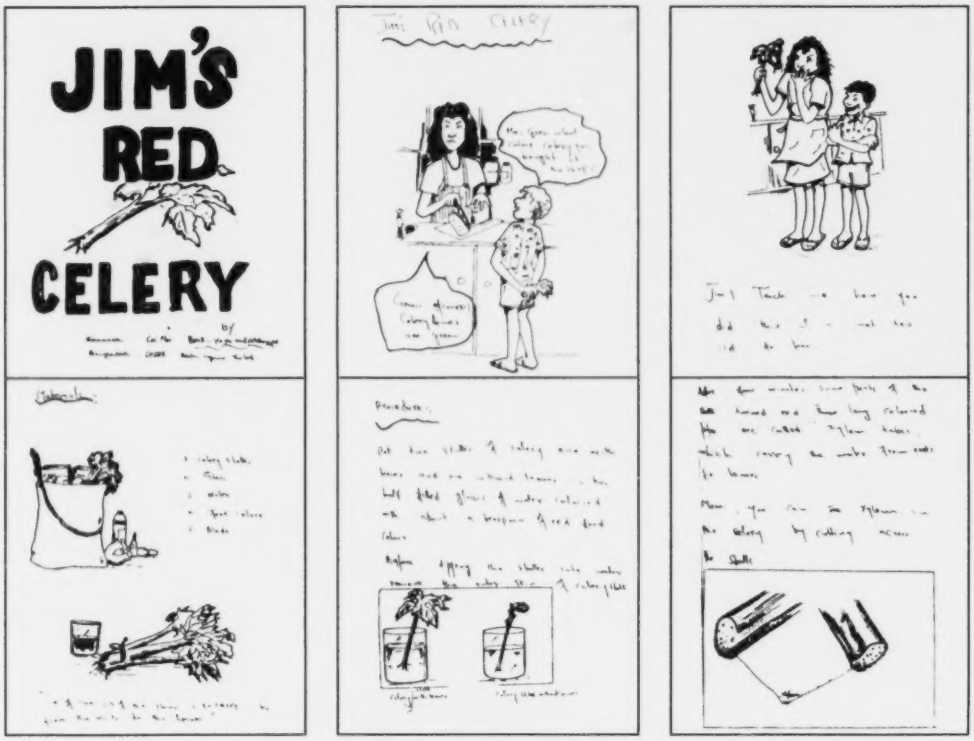
Mr. Md. Nurunnabi Khandker (Bangladesh) Ms. Yu Yu Hlaing (Myanmar) Ms. Petcharaporn Roenrom (Thailand)
Ms. Cai Mao (China) Ms. Rubina Nazli Goindi (Pakistan)




Mr. Hasan Hameed (Maldives) Mr. Harold Ure (Papua New Guinea) Mr. James Kinuthia Karaka (Kenya)

THE MAGIC
CABBAGE
Science Magic You Can Do
By
James Karaka, Harold Ure & Hasan Hameed
Amaze your friends
With the Magic Cabbage
This is what you must do
Get a small purple cabbage.
Dip it into a bowl containing equal amounts of water and vinegar.
Surprise!
You can get the purple colour out of the cabbage. Here is how.
Scrape the surface of the cabbage leaf with a knife into a dish.
The purple pigment can be made to leak from the scrappings.
Put the scrappings into a glass containing some water.
Mix this well with a clean stick or spoon.
You will use this solution to sort food materials into three groups.
Get as many samples of things you eat as you can. Arrange them on a table.
For each food material add some water to get a solution. In some cases you may have to crush the material.
Now take each solution and put it into a white dish. Add a teaspoonful of pigment solution. Note the colour changes in a
table.
FOOD MATERIAL
RED
BLUE
VINEGAR
The cabbage is purple because it contains a purple pigment. These food materials that turn the pigment red are called acids. Some food materials turn the pigment blue. These are called alkalis. Food materials that do not change the colour of pigment at all are neutral. Now taste all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Mr. Md. Nurunnabi Khandker (Bangladesh)

Ms. Cai Mao (China)

Ms. Yu Yu Hlaing (Myanmar)
Ms. Edith Figueredo de Urrego (Colombia)

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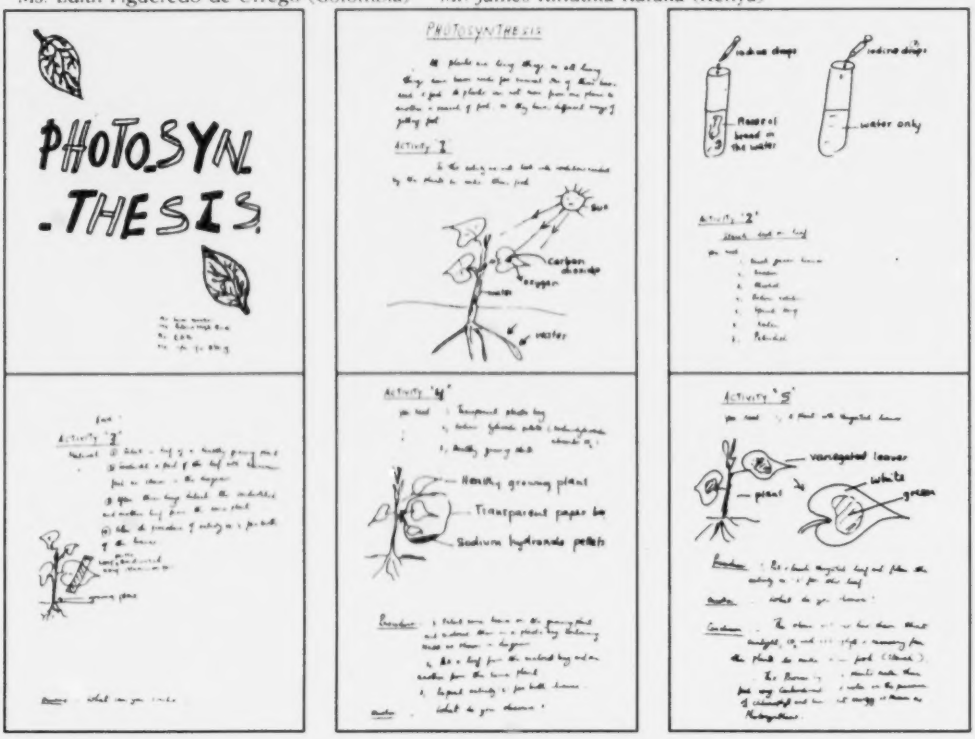






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## Group-B: "Our Ecology and Science"

conducted by Dr. Takahisa Hanya & Mr. Saki Itoh

Dr. Hanya discussed the importance of telling children about various social and ecological issues in science books in such a way that they would be interested in and understand these issues. It was the main purpose of this session that each participant should produce such a science book which would give children accurate knowledge about nature, and make them think for themselves about the ecological problems in their countries.

On the first day, the participants went to Ginza street in Tokyo in the morning to observe how much garbage is picked up and collected from the streets of Tokyo. Then they visited the Tokyo Metropolitan Government Office to get information on garbage disposal problems in Tokyo. Then they visited one of the garbage disposal plants near the Tokyo Bay. Based on such actual visits and observation, the participants developed science books for children on ecological issues. Each participant made the plan of his/her book, objectives and wrote a part of the book.

### Members of Group B

Mr. Tanding Wangyel (Bhutan)
Mr. Rajendra Joshi (India)
Ms. Nuryani Y. Rustaman (Indonesia)
Ms. Nahid Farian (Iran)
Mr. Thongkeo Asa (Laos)
Ms. Mahanom bte Mat Sam (Malaysia)
Mr. Razak Abu Bakar (Malaysia)
Mr. Budsurengiin Tumendemberel (Mongolia)
Mr. Mohan Gopal Nyachhyon (Nepal)
Mr. Kim Joo-Hoon (Rep. of Korea)
Ms. Kim Yun-Hi (Rep. of Korea)
Mr. G.L.Wimaladasa Samarasinghe (Sri Lanka)
Mr. Phongchai Sriphan (Thailand)
Mr. Phi Hoang Cuong (Viet Nam)

**Mr. Tanding Wangyel (Bhutan)**

Ecological Problems in Bhutan

1) Garbage disposal 2) River water pollution
3) Proper toilets
4) Living place for domestic animals
5) Deforestation

Title: Forest

There are lots of forests in Bhutan and many people depend on forests and the products for their daily use like wood for cooking, making furnitures and building houses. So I feel it is important that people know of the importance of forests and use the forests sensibly and find ways of replacing the trees cut down through afforestation before the forests start disappearing.

Objectives:

To let the target readers be able to:
a) Discover the usefulness of forests.
b) Know the importance of forests and their products.
c) See the role of forests in regard to the animals, insects and birds in the forests.
d) Find out the effects on the environment if forests were destroyed.
e) Create posters to make people aware of the need to save forests.

Contents:

1. Uses of forest products 2. What do we get from forest.
3. Life in the forest. 4. Without the forest.
5. Making posters 6. Interviewing the forest officer

**Mr. Rajendra Joshi (India)**

Environmental Problems in India

1. Deforestation 2. Soil Erosion
3. Air Pollution 4. Water Pollution
5. Chemical Pollution of Water,Air and Living Organisms (mainly due to our use of fertilizers pesticides and weedicides)
6. Environmental Problems Arising due to Inefficient System of Garbage Disposal
7. Noise Pollution (primarily urban problems)
8. Radiation Hazard (a potential threat of leakage of radiation from atomic power plants and other nuclear installations)

Theme: Air Pollution in metropolitan cities and other industrial towns of India (for the age group 11 - 14+)

The heavy vehicular traffic; smoke and other chemical discharged by factories and power generating plants; fuel burnt for domestic and industrial purposes often pollutes the air to such and extent that everybody children living in metropolitan cities experience a choking feeling and sometimes irritation in eyes and nose. Since the problem chosen directly concerns the target group, I think they might feel interested

Table of Contents:

1. Introduction 2. How clean is the air I breathe
3. Let me find out the pollutions of air
4. Is there a safe limit?
5. Who else could be suffering
6. Is there a way out?
7. Our rights and responsibility

**Ms. Nuryani Y. Rustaman (Indonesia)**

Ecological Problems in Indonesia

1. Toilet's habit
2. Garbage processing
3. Sound pollution (traffic, factories, etc.)
4. Water pollution (toilet, garbage, etc.)
5. Soil pollution (insecticide, garbage, etc.)
6. Air pollution (dust, $CO_2$, CO, etc.)
7. Cultural pollution (western and imported minded)

Topic: "They're Still Useful"

1) Rational: The volume of garbage increase rapidly. There will not be enough space for human being to live, if it still goes up. There is a kind of garbage that can be reduced by recycling it. Most of the people do not realize that decomposers need time to make certain kind of garbage decay.

2) Purpose:
- To reduce digestible garbage by making use of it.
- To make young people aware that certain kind of garbage is not really garbage.

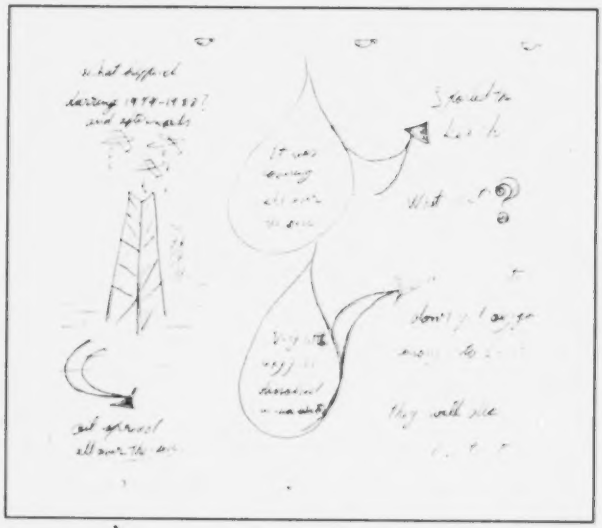
Outline

1. Introduction
2. Garbage and "Garbage"
3. Reducing Garbage
4. Making Use of "Garbage"
5. Distributing Your Ideas
6. Incredible Machine

**Ms. Nahid Farian (Iran)**

Topic: "Sea Pollution"

In the south of Iran is Persian Gulf. We have about two thousand kms coast line of the Gulf. A lot of people are living on this water, getting their food from the Gulf and their jobs too. As we are developing country thus the living situation of people getting worse and worse.



**Mr. Thongkeo Asa (Laos)**

Enviromental Problems in Laos

- Forest destruction
- Water pollution, lack of drinking and usable water
- Area pollution (wastes in towns)

Title: "Wastes"

In my country people are not enough educated in social life and environment. They consume lot of things but they throw out wastes (garbages) to everywhere that causes dirt, closure of water drain, and sources of some contagious diseases. I should like to make my new generation have concept, skills and attitude forward environment.

Table of items:

Who causes wastes
What do the wastes give us
What kinds of wastes do you know
Where should we through out each kind of wastes

**Mr. Abd. Razak Abu Bakar (Malaysia)**

Environmental Problems in Malaysia

a) Sea pollution: mainly due to the oil spill.... or sewage discharged into the sea.
b) Water pollution: due to the effluent discharge from factories into the rivers.
c) Air pollution: due to the emission of gases from factories and carbon monoxide from motor vehicles. The garbage collection and disposal also cause air pollution.

However, the most important issue is the sea pollution. This is due to the fact that the sea is a source of food (fish, etc.) for the people and also the source of income for fishermen.

Content

1. Introduction
2. Why there are many waterways in the world
3. The flow of currents in the Straits of Malacca
4. History of the Straits of Malacca
5. The economic importance of the Straits of Malacca
6. How ships are navigated
7. Major oil tanker collisions
8. Ships collisions in the Straits of Malacca
9. How to prevent the collisions

Glossary
Index



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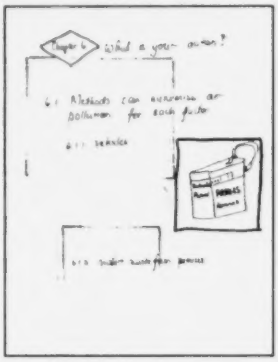
**Ms. Mahanom bte Mat Sam (Malaysia)**

Environmental Problems in Malaysia

1) Air pollution: Caused by public, garbages, factories, vehicles, agricultural chemical compounds and etc.
2) Water pollution: caused by waste from factory, premises, agricultural chemical compounds and etc.
3) Soil pollution: caused by agricultural chemical compounds and etc.
4) Sea pollution: caused by sea transportation, etc.

Title of Book: "Safe Your Life" (for age 11-12)

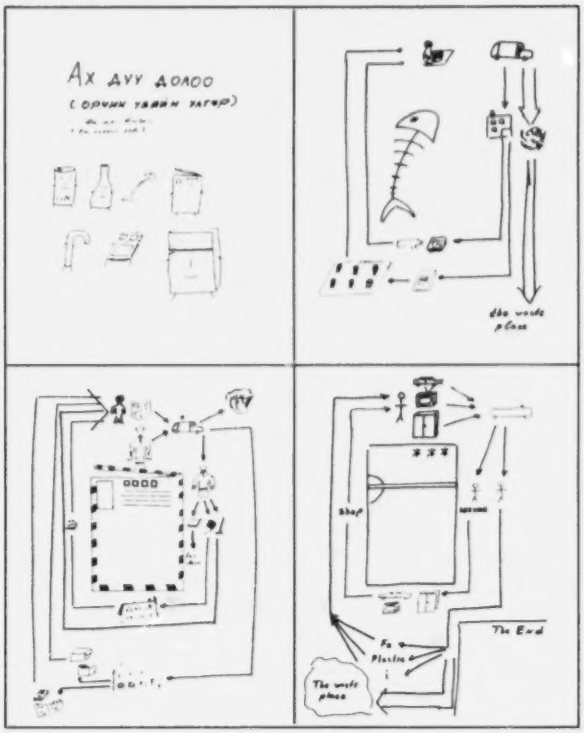
- to aware children about the environmental pollution
- to aware children how important fresh air in human being.
- to aware them what are the factors can cause air pollution.
- to aware them what kind of disease can be caused by air pollution.
- to make them know how they can take part in preventing air pollution in their area.



Contents

1 Introduction
2 Air and Breathing Process
3 Air and Our Health
4 What Causes Air Pollution?
5 Who should be Blamed?
6 What is Your Action?

**Mr. Budsurengiin Tumendemberel (Mongolia)**

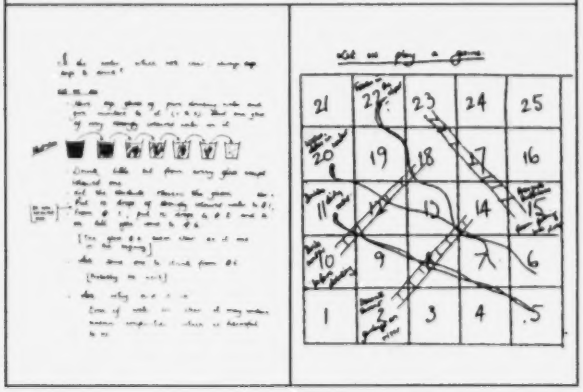


**Mr. Mohan Gopal Nyachhyon (Nepal)**

Environmental Problems in Nepal
- water pollution - deforestation: burning, cutting
- air pollution: vehicles, factories - sewage/garbage

Title of a chapter: "How we pollute water?"

Water is considered very holy in my culture and so a river is the purest form. Apart form its other use, the other activities done in the river include - cleaning, washing, cremating and flowing the ritual products. Doing these activities people hardly think that they are polluting the river. And so using water directly from these rivers make people sick and a large number of children die of diarrhea. There is a great need of educating people about it.



**Mr. Kim Joo-Hoon (Rep. of Korea)**

Environmental Series: Supplementary Materials for Environmental Education
Target Students: Primary Children 2-4 Grades
Objectives: Understand How Garbages are produced, processed and Disposed. Raise attitude to save materials in everyday life and conserve nature
Contents:

1. Garbage Mountains 2. The Bags Used in Supermarket
3. The Lost Forests 4. Acid Rains
5. Melting Iceberg (Ozone Layer and the Refrigiator)
6. Where Have Gone the Skyfishes in Han River
7. Disappeared Ferns
8. Without Gerbages - Recycling of Wastes in Everyday Life

1 Garbage Mountains
(1) Garbage Mountains
- Recognize how much garbages are produced in Seoul
Show what kinds of garbages are in the garbage mountains
(2) Where Does the Garbages Come From
- Recognize when such garbages are made in our life
(3) How Does the Garbages Carried to the Garbage Mountains
- Understand how garbages are collected and carried to the garbage mountains
(4) How Does the Garbages Treated
- Understand that how garbages are treated to make less harmful materials
(5) NIMBY (Not in My Back Yard) Why?
- Understand social problems related to garbage treatment.
(6) What Can We Do to Reduce Garbages
- Understand the possible methods to reduce garbages and raise attitude to practice reduce wastes in everyday life





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**Ms. Kim Yun-Hi (Rep. of Korea)**

Title: "The Reverse Side of the Coins"

A common environmental problem of industrial countries is how to dispose of industrial waste. This problem grows greater in our country as it becomes more and more industrialized.

The reason I chose this title is;
(a) to help students realize that industrialization benefit creates problems. One of them is environmental pollution.
(b) to introduce a philosophical notion of duality to students and help them to understand that everything has a right wide and reverse side.

Contents:

(a) Introduction:Industrialization with its good and bad effects.
(b) Industrial waste in our country
(c) Air, soil and water pollution
(d) Ways and means to dispose of industrial wastes
(e) Perspective of this problem

Finally, through my work I'd like to help students to identify the harm of industrial waste, and to help them to have a right attitude forwards environment.

**Mr. G.L. Wimaladasa Samarasinghe (Sri Lanka)**

Environmental problem in Sri Lanka
1. Waste disposal in urban areas
2. Urbanization
3. Water pollution
4. Clearing forests
5. Air pollution in urban and industrialized area

Title: "Be a Friend to Waste and Garbage"

Contents:
1. Introduction
   Danger and the harmfulness you have faced on disposing waste and garbage in daily life
2. What's to be done
   Magnitude of the problem if not handling waste and garbage properly.
3. Can't we be a friend to wastes and garbage. Develop a thinking on well treated method of handling waste and garbage in daily life.
4. How and why?
   Easy method of handling waste and garbage in daily life and usefulness of creating new attitudes to keep a regular method in disposing waste and garbage in daily life
5. Conclusion
   Emphasis on attitude

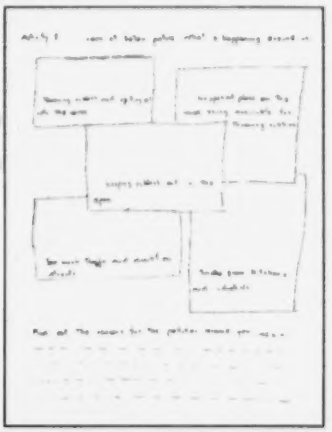
**Mr. Phongchai Sriphan (Thailand)**

The environmental problems in Thailand are:
1. Water pollution
2. Air pollution
3. Soil erosion
4. Noise pollution
5. Visual pollution
6. Garbage problem

Title: "Wastes Around Us"

Bangkok is the capital of Thailand, and it is also the country's political, economic, and cultural center. Particularly, many people are migrate to Bangkok. So, the population in Bangkok is getting more and more. The city are getting bigger. Together with it, the wasted products is also getting more every day. This is making our county very dirty and uncomfortable to live.

Content:
1. Everyone want to live clean
2. Things we waste
3. Wastes make pollution
4. Type of wastes
5. How can we live clean



**Mr. Phi Hoang Cuong (Vietnam)**

Vietnam is being in its first chase of industrialization and so it is faced with many environmental problems. In cities, there is a big problem of noise and air pollution due to exhaust fumes of the increasing number of motorbikes and smoke if coal ovens (electricity is available but too expensive). These are problems of out of necessity. But there is a more common environmental problem that we could help to resolve if we have good habits in our everyday living. This is the problem of dust and garbage.

Title of the book: "Identify Our Omnipresent Enemy"
Objectives of the book
a) helping the readers to understand and remember better the lessons in the "General Knowledge" book, to go deeply and broader into the questions dealt with in the lesson.
b) helping them building good habits. Still common among our city-dwellers are these bad habits:
   - to throw garbage to the streets
   - not to have lids for dutbins
   - to breath dust, to play in dust
   - no to mind of the neighbor's cleanness
c) building a sense of community
   Environment is one to all men and women living in a same place. One cannot build a clean and healthy environment for himself or for his family alone and let the neighbors living in polluted conditions. So, not only as a science book, it tries to have also a social meaning, an ethical meaning in that it helps building a way of living, a sense of community, an attitude towards the others...
d) opening a window to the world by introducing solutions and practices applied in other countries, for instance in Japan.



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# PART III.

## Present Situation of Science Book Production and Constructive Suggestions

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## 1. Practical & Constructive Suggestions for Producing Good Science Books for Children & Youths (by New Practical Method data analysis)

### • • • • • What is NP-Method? • • • • •

The New Participation Method (NP-Method) is a method of data analysis to identify needs, problems and solutions of all levels on the topic comprehensively and quickly, with the participation of all members.

Through actually writing the items down on small slips of paper which will later be pasted on a large sheet of paper, the members can understand the situation concretely and easily translate it into action.

**Procedure of NP-Method**

Participants are divided into small groups of six to seven persons.

1. Firstly, the group members decide the topic and freely discuss problems of the topic for 30 min., freely without any referring to any material, to have some idea as to what items to bring up as important. At this stage all members should limit their talking time to within 3 min. each.

2. Each person writes down 10 different items they can think of, on 10 slips of paper (3.5 cm x 10 cm). About 30 min. is given for writing and they should be written without referring to any material. The slips are the basis for a data map, so they should be written in the following manner:

   a) Simple and in short sentences;
   b) Content clear and practical;
   c) Easily understood by everybody.

3. Then, each person reads out what he/she has written in the group in turn and others listen to the content of the items. The slips are then grouped according to their similarity, and then content of all items raised are summarized into a sentence for each category. All slips are pasted on a large sheet of paper and the content summary is written down at the top of each category. It is a kind of data map which helps to understand the situation and to proceed to the next step, e.g. solutions.

4. For instance, you can make a data map on 'problems', based on which you can follow the same procedure for the 'solutions' and then your 'practical actions'. This method has proved very effective for identifying needs and problems in the past ACCU literacy workshops and training courses.

## Report of Group-A

Members of Group A

Mr. Md Nurunnabi Khandker (Bangladesh)
Mr. Tanding Wangyel (Bhutan)
Mr. Rajendra Joshi (India)
Ms. Nuryani Y. Rustaman (Indonesia)
Ms. Nahid Farian (Iran)
Mr. Thongkeo Asa (Laos)
Mr. Abd. Razak Abu Bakar (Malaysia)
Mr. Hassan Hameed (Maldives)
Mr. Saki Itoh (Japan)
Ms. Kurokawa (ACCU)
Ms. Yorozu (ACCU)

### Introduction

Although the main aim of the group activity is to brainstorm practical and constructive suggestions for producing good science books, this activity was preceded by a discussion of problems hindering the production of quality science books. From the discussions, it transpired that the problems of developing countries are essentially the same. In general these problems arise owing to the shortage of human and material resources, lack of comprehensive pre-planning and under-development of the infrastructure. Briefly, these problems are:

(a) Shortage of qualified authors
(b) Unavailability of competent illustrators, layout artists and designers
(c) Unavailability of modern technology for book production
(d) Unplanned implementation and
(e) Lack of reference materials
(f) Lack of time
(g) Paucity of funds
(h) Constraints imposed by the vocabulary of native language.
(i) Lack of qualified science teachers and well-equipped laboratories to make effective use of the books
(j) Difficulties in distributing the books

Suggestions for producing quality science books were made in the light of these identified problems.

### Suggestions

Using the NP Method, the eleven participants suggested a large number of ideas. For reasons of parsimony, only a summarized list of suggestions can be included in this report.

The suggestions can be categorized under three main headings:

(a) Organization of Production Team
(b) Presentation and Content Organization
(c) Support for Effective Use of the Books

(A) Organization of Production Team

1. Science book writers should have a sound scientific background in science and a close liaison with scientists. Whenever required training programmes should be organized for writers.

2. National and international agencies should develop a means to disseminate relevant information to guide writers of science books about scientific discoveries and innovations.

3. Illustrators of science books should have a background in science and training for illustrating science books.

4. Efforts should be made to attract talented illustrators and writers for science books by providing more funds through government agencies and NGOs.

5. Editors should have a science background.

6. Science-book writing should be a collaborative effort of authors, illustrators, editors, designers, printers, etc. from the planning stage. At the same time, the role of each should be well-defined.

(B) Presentation and Content Organization

1. Content must be selected such that it is relevant to the learner's age-group.

2. Science content could be introduced through legends, folk tales, drama, games, etc. to make science learning enjoyable and familiar to students.

3. Content must be organized from simple to complex, concrete to abstract and familiar to unfamiliar guided by research and knowledge of learner's background.

4. Presentation of the content should allow learner to interact with the text, maintain curiosity and encourage self-learning. Concepts must be illustrated with familiar examples.

5. The language of the text should be simple and within the grasp of the learner.

6. Standard vocabulary must be used as far as possible. If terms are not found in the vernacular language, use established foreign words with proper explanations and glossaries.

7. A glossary of technical terms should be a part of every science book.

8. Demonstrations and activities must be tried out before inclusion in the book. These ought to be done using readily available materials.

9. Illustrations should be clear, attractive, accurate and of learner's perspective.

10. Science books should be free from all biases.

11. Before science books are published they should be trailed, reviewed and necessary changes made.

(C) Support for Effective Use of the Books

1. Science books must be reasonably priced.

2. Science books must have companion teacher's guides written by competent authors.

3. Competitions must be organized at national and international levels for science books.

4. Steps should be taken to upgrade libraries for
   (i) providing better reference for writers,
   (ii) enrichment of students' learning from science textbooks used at school.

**Conclusion**

The members of the group felt that many of the above suggestions can be carried out in the member countries with little expenditure. What is needed is the awareness of the underlying reasons for these suggestions at all levels.

For most developing counties, the production of local science books started rather late. In recent years significant advances have been made in the member countries in this regard. The members are of the opinion that these training courses could catalyze the present book development efforts towards excellence.

## Report of Group B

Members of Group B

Ms. Mahanom bte Mat Sam (Malaysia)
Mr. Budsurengiin Tumendemberel (Mongolia)
Ms. Daw Yu Yu Hlaing (Myanmar)
Mr. Mohan Gopal Nyachhyon (Nepal)
Ms. Rubina Nazli Goindi (Pakistan)
Mr. Kim Joo-Hoon (Rep. of Korea)
Mr. Phongchai Sriphan (Thailand)
Mr. James Kinuthia Karaka (Kenya)
Mr. Hiroshi Tsukahara (Japan)
Mr. Aoyagi (ACCU)

A. **Nature of the Books**

1. The writer should understand the child real life situation and write relevant material.

2. The writer should learn children's psychological developmental stages as well as science itself, curriculum and learning outcomes.

3. Science textbooks have to be attractive to meet children's interest, easy, clear and activity oriented one to meet children ' s level.

4. Languages should be at the level of the children.

5. Beside English language, material from other languages should also be provided.

6. The specifications of text books have to be fixed.

7. The presentation should have balance between the content and process in order to evaluate the process, scientific problem solving abilities of students.

8. There should be enough reading material for children apart from textbooks.

9. Standardization of scientific terminology for each country.

B. **Field Testing**

1. Newly developed science text books have to be field tested and revised to make more relevant for children before practical application.

C. **Man Power**

1. Writers should be provided with information on up-to-date scientific knowledge and the current curriculums.

2. There should be consultations and coordination among writers, illustrators, editors, publishers and curriculum developers.

3. The most suitable writer should be selected on the subject to write.

4. Job descriptions and responsibilities have to be clearly explained.

5. Writer, publisher and distributor should sign an agreement and should be given enough time, good facilities to produce science books.

6. The writers, journalists, illustrators and editors must have training for their respective works.

D. **Government Policy**

1. National language should be taken care of in producing science text books.

2. The government should make a national policy in changing the curriculum in terms of time.

3. Must have a responsible body for doing research work.

## Report of Group C

Members of the Group C

Ms. Lourdes M. Ferrer (Philippines)
Mr. G. L. Wimaladasa Samarasinghe (Sri Lanka)
Mr. Harold Ure (Papua New Guinea)
Ms. Kim Yun-Hi (Rep. of Korea)
Ms. Petcharaporn Roenrom (Thailand)
Mr. Phi Hoang Cuong (Viet Nam)
Ms. Edith Figueredo de Urreg (Colombia)
Ms. Chie Fujita (Japan)
Mr. Tajima (ACCU)
Ms. Motoyama (ACCU)

### Introduction

It is necessary to identify the problems in the field of science books for children and youth in the region to make practical and constructive suggestions for producing better science books for children and youth. It is evident that if the problems are identified we will be able to take remedial action to promote qualitative and quantitative production of science books. In that context we were able to categorize important problem areas in producing better science books for children and youth in Asia and Pacific region. Detail analysis of those problem areas show the common factors that limit the development of production of science books for children and youth in most of the countries in the region.

### Problem areas

1) Pre-preparation for production of material

We understand that it is essential that proper planning must be done prior to commence the process of production of science books for children and youth. So that we consider that pre-preparation activities must be the first part of the process of production of science books for children and youth. Most of the countries in the Asia and Pacific region neglect this important step in their plans for production of science books for children and youth. With prior to writing science books it is necessary to

take steps to overcome the constraints in administrative, training and collaboration fields to promote books in better quality for the children and youth in the country. It is important to uproot the limiting components of the process of producing better science books for children and youth.

2) Content of Science Books

No definite criteria has been introduced to apply on the content of the science books written for children and youth in the countries in Asia and Pacific region. Although the curriculum developers lay out the syllabus, writers are not competent enough to cover all the aspects such as applications and developments of new technology and current issues in their text books due to the fact that they do not have enough resource material. In most of the countries in the region content for supplementary reading has been chosen by the writers as they wish. It is taken in to consideration that content of science books written for children and youth must be covered all the aspects of life including global issues. Science books for children and youth must have the ability to develop observational and experimental approach and scientific and constructional thinking in children and youth. some mechanism should be developed in this regard to help the writers, illustrators, editors and publishers collectively to select the appropriate and up-to-date content for their science text books and the supplementary books for children and youth in the region.

3) Presentation Approach

Though it is attractive or not the writers in the countries in Asia and Pacific region use deferent modes of presentation in producing science books for children and youth. We understand that those modes of presentation used in most of the countries in the region cannot meet the satisfactory level. It is necessary to take remedial actions to upgrade the presentational approaches to meet the international level and the standard to get better performance of the children and youth in the region.

Behavioral patterns of children and youth are not been considered by the writers, illustrators and publishers in most of the countries in the region. This obviously shows the production of science book for children and youth in Asia and Pacific is in poor quality. Most of the countries in the region do not produce science books with colourful illustrations. Editing of science books for children and youth which is very important in the process of production of science books has not been developed in most of the countries in the region we observe.

Total complexion of science books produced must be attractive to the children and youth they used as text books or supplementary books. All these aspects have been taken in to consideration for finding practical and constructive suggestions for producing better science books for children and youth in Asia and Pacific.

**Suggestions**

Considering all the aspects of the problems identified above following suggestions are made to promote production of science books for children and youth in Asia and Pacific region.

1) Pre-preparation for Production of material

1 Administrative concerns
Define an encouraging policy for the publication of science books with subsidies, funds, rewards for best producers and best books.

2. Training
It is essential to give a proper training for the producers to introduce modern techniques to produce better quality science books in national and lower levels.

3. Collaboration
Close collaboration with all experts of the field such as writers, illustrators, editors, science educators, journalists, educational psychologists and even language people and educated parents is essential.

4. Network
An international organization of science writers is necessary for collaboration, exchange of experience and materials and dealing with global issues.

5. Feed Mechanism
Writers of science books should get feed back from children and parents to know their opinions.

6. Provision for References
Reference materials should be provided for writers as well as attractive supplementary books are needed for children.

2) Content of Science Books

1. Content
content of science books should include the basic and fundamental knowledge of science, its applications, especially the developments and advancements in technology, current issues pertaining to environment, health and nutrition, sanitation, cultural and social concerns, history and philosophy of science. There should also be a component activities that will develop creativity.

2. Constructionism
In developing the science concepts, children's previous knowledge, ideas, experience (daily life) especially those in play and encounter with the surroundings should be used in writing science books. Their needs and preferences for learning should also be considered.

3. Skills
The content should include activities to develop skills of thinking, processes of science, manipulative skills and opportunities to contrast science (e.g.. use of games)

4. Evaluation
Evaluation systems should be arranged.

3) Presentation Approach

1. Mode of Presentation
Presentation should have innovative design and be interesting and interactive.

2. Vocabulary Level

Content should be in a clean and easy to understand manner using children's language, keep technical terms in English, so that confusion as a result of translation will be avoided.

3. Illustrations
Visual presentations, colourful illustrations are necessary to show abstract conception in clean and effective way.

4. Overall Quality
The books should have the best óverall quality in every aspect, for example colour, paper, printing and binding etc.

**Conclusion**

It is easy to identify the problems and make suggestion to overcome the limitations for production of science books for children and youth. It is rather difficult to find strategies to make suggestions in to action. Governments of all developing countries in Asia and Pacific region have to take part in making strategies to make these suggestions in to action.

We strongly suggest that the strategies make to implement a developing plan for promoting science book production for children and youth should be included in to an action plan prepared according to the government policy of the country concerned. This should be a part of the national development plans in countries concerned in the region.

Action plan must be ready with the funding programs of the countries concerned. Most of the governments of the countries in Asia and Pacific region are reluctant to allocate enough funds for such programmes. Intellectuals of the countries must have to convince the governments to change such attitudes for the sake of next generations. If not we will be failed to develop a better phase of production of science books for children and youth in Asia and Pacific region. Development of production of science books for children and youth is a collective effort of all parties concerned.

## 2. Characteristics of Science Textbooks and the Problems in Writing Science Books in Respective Countries (Individual Reports of Participants)

. These reports were edited by ACCU.

### *Bangladesh*

by Mr.Md. Nurunnabi Khandker
Editor
National Curriculum & Textbook Board

National Curriculum and Textbook Board (NCTB), Bangladesh is entrusted with the responsibility of preparing curriculum and syllabuses and producing quality textbooks from primary to secondary level. NCTB commissions competent and experienced writers to write textbooks and then finalizes the process of producing books after reviewing and improving with the help of other specialists.

Characteristics of science textbook:

For historical reason, poverty and unemployment are serious problems in Bangladesh.. For the solution of these problems, importance is given to science and technology in the syllabus and necessary steps are taken by reforming the educational system. In primary level from classes 3 to 5, a new compulsory subject named "Introducing Environment" is introduced so as to inculcate the basic ideas of social science and natural science in the minds of children.

Since Bangladesh is a predominantly agricultural country, eagerness and dignity for agriculture must be created in the mind of the learner. About 80% people of our country earn their livelihood by cultivation and most of them are illiterate. They have meager knowledge about primary health care and most of them are suffering form malnutrition. So in primary science textbooks, the causes of common diseases, their remedies and first aid are explained, so that the children have basic ideas about these diseases and can help their parents at the time of emergency. Moreover, the most serious problem of the present age is environment pollution. From the primary level we give emphasis on agricultural, health and environment education, and nutrition science.

Most of the villagers of Bangladesh are using the old traditional methods even now because they don't have the knowledge about modern techniques of cultivation. So the topics like different techniques for agricultural development, use of fertilizer in agriculture, use of insecticide, sowing of high yielding seeds, etc. are discussed and explained.

The main aim of education system of Bangladesh is to build a prosperous human resources who can develop their imagination, thinking power and inquisitiveness. So the textbooks ask the students to do the experiments and answer the questions by themselves. However, most of the institutions do not have requisite laboratory facilities to do this "Do It Yourself" type of experiments.

Major Problems in writing science books for children and youths:

NCTB is the only organization in charge of producing textbooks for primary and secondary level. Individual authors write and publish textbooks for higher levels and also write general science books.

1. Up-to-date information
   Recently published foreign journals, periodicals, science books etc. are not easily available.

2. Terminology
   Sometimes it is difficult to get appropriate terminology for scientific terms in mother tongue.

3. Production cost
   Printing cost for science books is very high in comparison to other books in our country.

### *Bhutan*

by Mr. Tanding Wangyel
Teacher
Daifam Primary School

In Bhutan, the education system at the primary

level comprises 7 years. In 1985, the Department of Education established the CTDD (Curriculum and Textbook Development Division) and with it came the NAPE (New Approach to Primary Education).

The Characteristics of Science Textbooks

In the primary level science is taught as a separate subject only from Grade 4. In the lower grades (Pre Primary to 3) science is taught through Environmental Studies.

Till 1990, the Indian Curriculum Textbooks were followed including science. Some of the chapters in the text were irrelevant to the needs of our country. Therefore in 1990, a new curriculum started from Grade 4. The new science textbook was developed along with a teacher's guidebook.

The books are given free of charge to students but they have to be returned at the end of the year. The books do not have a hard cover and sometimes the pages fall off. The diagrams and illustrations in the book are not coloured. After the book is written a workshop is held where teachers from different parts of the country meet with the CTDD Personnel to discuss in the implementation of the book and changes to be made on some topics during the pilot-test year. The lessons in the text are all activity based on learning by doing mainly for the development of skills.

Major problems in writing science books for children and youth

(1) Lack of experienced authors: There are very few writers. It is only 3 years ago that the first science textbook was written in our country.
(2) Lack of reference materials
(3) The regional differences of the country makes it difficult to write a relevant textbook for some schools in very remote places where children have not seen a car or bicycle or even a road.
(4) Quality: The books that we have at present do not have appealing colours. The sketches are in black and white which makes it unattractive for the readers.

## *China*

by Ms.Cai Mao
Editor
People's Education Press

People's Education Press (PEP) has been dedicated to the compilation and publication of teaching materials for primary and secondary schools. For 40 years, in accordance with the requirements of the development of educational reforms, the PEP has so far compiled and published 7 sets of nationwide teaching materials for primary and secondary schools in China. Each year, nearly 20,000,000 primary and secondary school students (almost the whole country's) use these textbooks.

Now we are engaged in the research, development and trial teaching of a new round of teaching materials for the Nine-year Compulsory Education. The new science textbooks including: Science - for primary school students (6-12 years old), Physics, Chemistry and Biology - for junior high school students (12-14 years old).

The characteristics of these new textbooks are:

1. Combine teaching knowledge with developing ability. (the ability of observing, experiments, planting, rearing little animals and manufacturing etc.)
2. Combine theory with practice; After the students have learned a concept, they are asked to use it to solve some questions.
3. Combine language with pictures; The new science textbooks are more colourful than old ones with more pictures. In primary science textbooks, more pictures are used than language.
4. Compile and publish a complete set - teacher's book, slides, teaching drawing, learning aid and student's reading materials after schools.

The major problems in writing science textbooks are:

1. Our science books are not beautiful because we are short of good quality reference materials and we can't take good photos by ourselves, and we can't use higher quality paper (because of the price of the books).
2. Lack of modern equipment, such as computers, to type, set type, design, etc..
3. The writers have no time to learn new knowledge to meet development of science in 1990's.
4. Less exchange of information with other countries.

## India

by Mr. Rajendra Joshi
Lecturer
National Council of Educational Research
and Institute (NCERT)

At the national level, the National Council of Educational Research and Training (NCERT), has the responsibility of developing model syllabus and textbooks for all stages of school education. The NCERT is the academic adviser to the ministry of Human Resource Development of the Government of India. The model syllabi and textbooks developed by the NCERT are made available to all States/ U.T.(Centrally administrated Union Territories)'s for adaptation or adoption. The states, however, also has the freedom to develop their own syllabi and textbooks. State Councils of Educational Research and Training (SCERT) have been established in almost all States/U.T.'s to look after this function. The syllabi and textbooks for the secondary and senior secondary stages are developed by the respective States Boards of Education which conduct public examination at the end of these stages. In many cases the State Boards approve the syllabus and recommend textbooks published by private publishers. Often more, than one textbook is recommended for each subject. However, the Central Board of Secondary Education (CBSE) prescribes NCERT textbooks for secondary and senior secondary stages.

In all textbook development programmes a large number of practicing teachers, subject experts and other functionaries are involved to review the materials at various stages of the development of manuscripts. The production of all textbooks is done by the Publication Department of the NCERT.

At the State level, nationalized textbooks are published by respective State Textbook Corporations. Different methodologies are followed by the States for developing manuscripts of science textbooks, especially for primary and upper primary stages. In addition to national and state agencies science textbooks are also published by a large number of Private Publishers. These are mainly written by individual authors or a group of two to three authors. These textbooks are usually prescribed by public (private) schools. However, these textbooks are mostly based on the NCERT syllabus.

### The characteristics of Science Textbooks

1) The contents

The content of existing science textbooks up to secondary stage reflects a distinct emphasis from the product of science to the process of science and from dry factual information to interesting, relevant and meaningful scientific knowledge. Efforts have been made to highlight the utilitarian aspects of science and to link science with daily life experiences so that children may appreciate the role of science and technology in the development of the society. The content of science textbooks accordingly deals with fundamental principles and their application in the area of health, nutrition, agriculture, energy, industry, environment and the hazards of misuse of science.

2) Organization of Content:

In earlier attempts, the formal rigid structure of various disciplines have been followed. Although "learning by doing" has been emphasized throughout and a number of student activities have been suggested in the textbooks, textbooks appeared to be meant for preparing children only for higher studies in science. With the introduction of environmental studies, integrated science and composite science up to class X, the organization of content in the existing science textbooks has become more informal and follows an approach wherein concepts of science may be developed by drawing examples from daily life experiences and immediate environment of the child.

3) Presentation of Content:

In the primary science textbooks in the late sixties, the concepts of science were presented in a hierarchical order in such a way that either the learner or the teacher had to perform an activity to move from one concept to the other. The integrated science textbooks for the upper primary stage, developed during 1975-79, had an altogether different format. In these textbooks, each unit was divided in five major sections, viz. Observation, Questions, Let Us Find out, Activities and What Have We Learnt and How is It Relevant. The main objective of following such a format had been to indirectly highlight the basic process of science. The existing science textbooks, however, have been developed on a traditional format although efforts have been made to present the content in a manner that the learner interacts with the text at every stage. Besides, salient features of the

earlier textbooks have also been retained.

4) The Physical Aspects of the Textbooks:

Composing is now mainly done with photo composing devices, instead of letter printing. The single colour cover designs have been replaced by multiple colour designs. The illustrations in the textbooks are mainly in the form of line drawings and black and white photographs. However, at the primary level the illustrations are in multiple colour; some illustrations in the upper primary science textbooks are also in colour.

One of the major objectives of national and state level agencies has been to provide low cost quality textbooks to school children. The NCERT and other state agencies has been successful in bringing out low cost textbooks with superior academic pedigree. The textbooks brought out by private publishers, on the other hand, cost four to five time that of NCERT.

The Major Problems in Writing Science Books

- the rigidity of the centrally prescribed science syllabi provide very little scope to the authors to exercise their ingenuity, imagination and originality in writing the textbooks.
- lack of research studies to provide proper guidance in respect of suitability of content, language proficiency and interests of children for a given stage of education.
- lack of training and orientation programmes for science textbook writers.
- non-availability of competent illustrators for science textbooks.

Some problems also relate to the mechanism followed for the development of textbooks by the nodal agencies like the NCERT. Often a writing team is a disparate group comprising authors drawn from different types of institutions from different parts of the country with differences in their sense of perspectives, experiences, perceptions of science education in schools, style of writing, language and lack of knowledge of previous efforts of others in developing science textbooks. As a result, it becomes difficult to coordinate the writing work and to maintain uniformity and coherence in presentation of the content. The authors, illustrators, copy editors and production experts often work in isolation, which also affects the quality of textbooks.

Another major problem is that the manuscripts are first developed in English (at the NCERT) which are later translated in Hindi and other languages. The translated versions of science textbooks often appear to contain a large number of unfamiliar terms because most of the equivalent terms drawn often from ancient Sanskrit language which are not a part of common vocabulary. The problem is further accentuated by the lack of competent translators. However, many states have begun to develop science textbooks first in their regional language and then translate them into English. The teachers and other users are also getting gradually familiar with the technical terms in their respective regional languages.

## *Indonesia*

by Ms. Nuryani Y. Rustaman
Lecturer
Faculty of Math. & Science Education
Institute of Teachers Training & Educational Sciences

The Characteristics of Science Textbooks

- published by private publishers for commercial purposes, poorly designed, not based on cognitive child development
- written by persons who are not involved directly in real situation (teaching-learning processes in classroom), theoretical, not practical
- written by persons with poor grammar background, confuse children's logic
- pictures are designed and drawn by illustrators who have not enough science background, less, text oriented
- pictures are drawn from adults' perspective, not attractive to children
- culturally taboo oriented, very few drawing in describing reproductive organ in textbook for youth (especially human's).

The Major Problems in Writing Science Books for children and Youth

Science textbooks for national use are produced by Center of Publication (Pusat Perbukuan). They are limited in number of pages and colour drawings, as they will be distributed to all parts of the country.

Writers find difficulty to find good illustrators, as there are very few illustrators who have interests in scientific drawings. The other difficulties are:

- to present science concepts in simple and understandable way
- to make the science books attractive and interesting for the readers and to meet the needs of heterogeneous society
- to produce low-cost science textbooks for primary school which can bring out the interests of readers.

## Iran

by Ms. Nahid Farian
Editor/Supervisor
Educational Research and Development

One of the baric problems in Iran is that children do not understand why they should study sciences. Science is a subject in which children are rarely interested, because it seems not to have anything to do with their real lines at first sight, especially when it is introduced to them just theoretically. The authors have to write the books which help children indirectly to find out the relation between the theories they study and the daily accessible experiences, and the practical uses of them in their real life and also to attract children's attention and stimulator their eagerness to know more and to read more books.

The lack of labs and other facilities for experiments is another problem. The authors of children's science books face the problems of differences between social classes with different life styles and the facilities available for them.

Some authors do not pay attention to the point that although children are not as capable as adults to recog ize what is correct and what is not, we are not supposed to write for them in a casual way. In contrast we are responsible for training them so that they can evaluate every details of the lives.

The lack of high quality paper and its high cost is a problem because the science books usually contain lots of coloured pictures printed on higher quality papers. Also, a book takes much time to be published because of the shortage of developed printing machines. On the other hand, translated books are easily available at lower costs, because they need less man power and time to be ready for being published.

## Laos

by Mr. Thongkeo Asa
Curriculum & Textbook Writer
Research Institute for Educational Science

In Laos the general school system is divided into five years primary school, three years lower secondary school and three years upper secondary school. Now a day in primary school science is given as compulsory subject from grade four to five.

The current science curriculum and science textbooks for primary school in Laos are not enough interesting nor easy understandable for children, because of their cover design, layout, setting, and lack of illustrations, pictures etc.

But according to the government policy, starting from 1993-1994 school year, the current primary school curriculum which has been used since 1975 will be placed by the new curriculum. Science will not be separate subject, but a part of life experiences called 'The World Around Us' which includes social studies and health education.

The new curriculum will be more conformed to the technology, present circumstances and reality of Lao society. Science aims at acquisition of knowledge on scientific skills, nature and environment and understanding of relations between human and environment.

Problems in Writing Science Books

1. Insufficient number of writers of science books.

Almost all science books in Laos were adapted from another languages and only one small organization which has small number of staff members (Research Institute for Educational Sciences) has been produced science books for primary and secondary schools.

2. Lack of qualified and experienced authors of science books.

Most lao science books writers have never been trained in book writing. The contents of science books do not engage children's interest.

3. Lack of reference materials

Due to very limited reference books the

curriculum and book writers face acute difficulties in looking for emerging ideas and concepts. The Research Institute for Educational Sciences (RISE) at the moment do not have regular supply of many kind of journals and books from abroad.

4. Lack of qualified teachers

Some teachers have never been trained in any Teacher Training Schools. Teacher Training Schools do not have good level .

5. Difficulties of publication and production

- Shortage of fund available for the publication:
- Low experience level of illustrators, designers and editors:
- Insufficient quantity of science books (many schools are without science books)
- Low reading habit of lao children and small book market.

## *Malaysia*

by Mr. Abd. Razak Abu Baker
Language Planning Officer
Dewan Bahasa dan Pustaka

The Characteristics of Science Textbooks

Science textbooks are written in accordance with the syllabus prescribed by the government. In primary school, children are taught relationship between man and nature. Children in lower secondary are taught the concepts of science and their applications in everyday life.

In introducing science, the school children are told the difference between science and technology. Science is the understanding of the various concepts, while technology is the application of the concepts in everyday life. Since the invention of the new technology is through research and development, the school children are introduced the importance of laboratory.

After the children understand the concepts of science, they are introduced the diversity of life. Living things consist of plants, animals as well as microorganisms. Also, at the end of each chapters the school children are asked to do exercises as well as to enrich their knowledge by reading selected passages. At age 16, they are introduced the specific fields of science - physics, chemistry, and biology. There is also an additional science, a subject tp complement the natural science.

Major Problems in Writing Science Books for Children and Youth

Authors for science textbooks do not face much problems because their works follow the guideline issued by the government. However, in writing a general science book for children and youth the author may face various kinds of problem.

(a) Difficulty in identifying the age group

Most science authors are university lecturers who lack the ability to present the essence of the subject in terms understood by the age group addressed.

(b) Difficulty in identifying the most appropriate approach

In producing an academic text, the author may use scientific terminology, but such difficult terms are hardly understood by people who are lay in the field.

(c) Difficulty in editing texts

Generally, science editors in Malaysia are not necessarily correcting spelling, terms, and punctuation marks, but often they do suggest the arrangement of the text, paragraphs, and illustrations. Normally science books for children and youth are fully or partly illustrated, thus the text has to be concise. The editor has to condense the paragraphs.

(d) Future Trends in science books in Malaysia

In Malaysia, many foreign science books for children and youth dominate the local market. This could be due to the fact that local publishers in Malaysia fail to break away from the school oriented publishing tradition. The local publishers are more interested in publishing supplementary texts because they sell better than other types of books. It can be said that, the more liberal and varied types of children and youth books have great potentials in Malaysia.

## Malaysia

by Ms. Mahanom bte Mat Sam
Education Officer
Textbook Division
Ministry of Education

At primary level, there is a subject 'Man and His Environment which comprises elements of science, geography, history, civics, hygiene and other areas of knowledge pertaining to man and his environmen'. Thus, indirectly science is introduced as a subject at primary level. The basic knowledge of science that they have learned at the primary level will be further developed and reinforced at the secondary level.

Problems in writing science book for children and youth.

1) writers are not able to produce quality science textbooks for primary schools because materials written are of higher level. They do not bring down the level of thinking to that which is suitable for primary schools.

2) try to produce good quality science textbooks for all students even though the students have different abilities in understanding the content of the book.
3) terminology - since the books are written in Malay language, problems may arise in having the correct terminology.

4) the ability of publishers to produce good science textbooks. The majority of the publishers are relatively new and are not able to do this because they do not have enough technical facilities.

5) time factor - to accommodate the continuity of textbook usage at school level, the textbooks had to be produced within a limited time. The writer publisher did not have enough time to study the syllabus, to do research and other related works in order to produce and science textbooks.

## Maldives

by Mr. Hassan Hameed
Deputy Principal
Majeediyya School

All schools in Maldives are required by the Ministry of Education to follow prescribed curricula. For the primary and middle-school level, the curricula are locally developed. Secondary curricula are of overseas origin except for Fisheries Science, Islam and the local language, Dhivehi.

The Educational Development Centre is primarily responsible for designing the necessary curricula. Educational Development Centre is also charged with the responsibility of writing all textbooks used in the primary schools. All books (except those for Fisheries Science, Dhivehi and Islam) used in secondary schools are imported from United Kingdom.

Science is taught in primary school (Grades 1 to 5) as part of environmental studies. The environmental studies syllabus consists of social studies and science. It is now felt by the teachers that there is insufficient science content in environmental studies syllabus. The syllabus is now being reviewed.

Science is taught as a separate subject only from Grades 6 and 7. The curriculum is locally developed but adapted from one used in the West Indies. Science is taught for two and a half hours per week. The textbooks used at the moment are from overseas.

From Grade 8 onwards science is taught as separate disciplines in the science stream: physics, chemistry and biology. All the science textbooks used at the secondary level are imported (except the fisheries science textbook).

Characteristics of the Science Textbooks

Most of the science textbooks used in the country are from overseas. They are carefully selected after much discussion with experienced teachers. They are often the best available in United Kingdom. However, they are characterized by the following:

(a) Since the books are written in UK, they have little relevance to the local situation.
(b) They assume a level of mastery of English that is not prevalent among the students in the Maldives to whom English is only a second language.
(c) They ignore the local culture.
(d) They are very attractively designed and produced.
(e) They are very expensive.

As noted earlier, there are no proper science textbooks produced in the Maldives except the fisheries science textbook. The environmental studies

textbooks are characterized by the following:

(a) They are relevant to the local situation. Examples quoted are derived from the students' own environment.
(b) They are written by authors who have no contact with the current school-going population. Thus, the structure of the language used in the books, depth of treatment of topics and organization of the content are often unsuitable.
(c) Most of the books are too simple and lay little emphasis on the science content.
(d) The content is, sometimes, sequenced improperly.
(e) Diagrams and layout are not attractive.
(f) Print quality is poor.
(g) Colour photographs are not present.
(h) They are very cheap.

Major Problems in Writing Science Textbooks

(1) Lack of qualified authors
As mass and modern education was introduced into the country rather recently, and because the population is small, there are not sufficient qualified authors to write science textbooks. Very few (about ten) graduate local science teachers are in the country.

(2) Lack of illustrators, layout artists and designers
At the Educational Development Centre which is responsible for the publishing of all textbooks in the country, there is only one illustrator. There are no commercial design firms which can undertake such tasks. Expertise in book illustration is rare in the country.

(3) Inexperience
Except for the environmental studies textbooks, the country began to produce its own general science textbooks only in recent years. The first book will be published in January 1993.

(4) Lack of good printing houses and printing technology
There are only three printing houses that can print in colour. Colour scanning of slides and photographs cannot be done in the country. Only one typesetting machine is in the country. Therefore, prices are often high and printing is slow.

(5) Student's environment
Many students in the islands are not exposed to many man-made objects. In many islands, there is no electricity, most have no TV, cars, bicycles, etc. Therefore, writing textbooks to relate to their local environment poses special problems, especially when the books must also aim at students in developed Male'.

(6) Unplanned implementation and evaluation of curriculum
The curriculum is rarely evaluated in a systematic way. These are due to the paucity of qualified people and the geography of the nation. There are 200 inhabited islands scattered in a vast ocean. It is time-consuming and difficult to visit these islands and study the problems. Thus the difficulties of the teachers and students, and their feedback are hard to collect. Decentralization will help to improve monitoring of curriculum but available resources favour central development of learning materials.

(7) Reference material
It is difficult to get access to good reference material especially information on local situations and environment.

(8) Time
Often textbooks have to be produced rather quickly. It stresses the authors and hence the best output cannot be produced. Field trials of books are not possible due to lack of time.

(9) Funds
Maldives being one of the least developed countries, the amount funds available for textbook production is very limited. Further, the books have to be sold very cheaply. These factors affect the quality of the book. It is not possible to hire the experienced and qualified people to write books. Attractive books in colour will be too expensive to produce.

(10) Language
The mother tongue of all students is Dhivehi. However, middle-school and secondary education is usually in the English medium. This poses additional constraints in the writing of science books. There is often very little vocabulary in the local language for the science concepts. Students thus learn the language of English and science concepts at the same time.

## *Mongolia*

by Mr. Budsurengiin Tumendemberel
Editor
The Publishing House of Textbooks and Children's Books
Ministry of Education

In Mongolia, the natural science is dominant and 70 percent of all secondary school programme is devoted to natural science. The government paid a constant attention to teaching the natural sciences and the specialists of natural sciences have been trained at home. Science textbooks have been compiled and published by our own Mongolian specialists since 1970-s at secondary level, and since 1980-s at other levels. Before that, the translated textbooks had been widely used in schools.

The country's population is quite small/about 2 ml. people/and the rate of young people aged under 16 is too high, therefore, secondary school textbooks and teaching materials are the types of books to be published in large numbers and copies. Just one textbook is usually published in 30-40 thousands, whereas mother scientific books are published in 500 to 3,000 copies.

At the time when the country is developing along the so called "Market economy" path it is of double importance for us to clarify the future policy in the above-mentioned field and to train specialists and children meeting the present-day needs and demands. And it is obvious that the role of scientific books will increase double. Up-to-the recent past the state schools dominated and operated throughout the country, but now we have different types of schooling like private schools, home teaching, company or brigade sponsored schools, even the primary religious schools.

Another vital issue of the present-day is the reintroduction of the national Mongol script instead of the Cyrillic alphabet. Accordingly new needs and demands have arisen like teaching the Mongol script to the whole population, documentation in the Mongol script and preparation of the textbooks and teaching materials in the national script. Therefore one of the urgent tasks of publishers is to publish scientific and other textbooks in the national script both qualitatively and in enough quantity. But today we face with certain problems in solving the above-mentioned urgent tasks and issues. They are as following:

1. The publishing technology is old-fashioned. The shortage of paper is a big problem as it is usually imported from abroad in hard currency and we do not get the currency from the state any more.

2. The old operating system in publishing was closed down but the new one hasn't yet been steadily introduced.

3. The preparation of the scientific books' prototypes is getting really difficult as the production cost of the books are getting very high. These types of books are 5-10 times expensive than the ordinary literary books. Another reason we do not need to publish books in too many copies and our users are populated scarcely.

4. With the reintroduction of the national script we face with a new problem that is we should transit the publishing from the horizontal writing to the vertical one. And here we face to start with such problems as the standard size of the books, their designs etc. We didn't have any wide experience in this field.

5. At present due to flooding of the country with video films and computer games the number of readers increasing sharply, therefore, there came out real needs for more colourful and attractive books with small texts so that we could attract more people. And naturally, this affects the cost of books as well. And at the time when the prices on goods are not stable and the inflation is rising all the time people tend to spend more on food rather than on books.

6. It is high time to upgrade the publishing workers and specialists' qualifications in accordance with the present-day requirements and demands.

## *Myanmar*

by Ms. Yu Yu Hlaing
Senior Assistant Teacher of
Curriculum Unit
Dept. of Basic Education

All schools in Myanmar are run by the government and the same syllabus is taught in every school. Each school conducts its own examinations except those for fourth, eighth and tenth. During the middle classes ( fifth to eighth standards) students are

required to take general science as a subject. General Science is a mixture of Physics, Chemistry and Biology. The syllabus is prescribed as a block syllabus for all the four standards. Each standard learns a portion of each sub-heading, finally covering the whole syllabus after four years.

Before 1985, primary classes learned rudimentary scientific ideas through a subject which was entitled "Study of the Environment". It was about that period that the government decided to begin teaching English from primary classes and to reduce at least one subject. Science was dropped as it was considered that middle class age children were more interested in science and were more likely to grasp the ideas. Primary level children has been taking Myanmar, English, Mathematics, Geography and History as regular subjects.

It is the duty of Curriculum Unit of the Basic Education Directorate to write and produce science textbooks in Myanmar. Normally they are the products of joint effort by members of an expert group on a particular subject. General Science textbooks contain contributions from many such groups. Each member is given a certain part of the book to write, with a senior member supervising and coordinating the work.

Many seminars, workshops and discussions are being held these days with a view to improve the education system in Myanmar. A large number of educationists and experts are of the opinion that there are many advantages in teaching science to primary students. Children are more impressionable and learning science at a younger age makes them more conscious of the environment and more intelligent. There is a distinct probability that it will not be long before science classes are reconvened in primary classes.

Major Problem in Writing Science Books

Science books are rare in Myanmar and science articles appearing in various magazines and journals are usually about modern developments and recent discoveries, written for readers with reasonable knowledge of science. Books and articles on scientific subjects which are suitable for general reading by children and young people are sadly wanting. Textbooks, therefore become the main if not the only source of science education for children. This is a condition that has to be borne in mind at all times by science textbook writers.

The writer of a science textbook for children has to assume that students have no previous knowledge on the subject. This total reliance on textbooks places a heavy burden on the writer.

A writer has to decide on where and how the starting point should be, how wide the coverage should be and how much detail is needed. Lack of information about the level of scientific knowledge of similar age groups in other countries posses a problem, as such information would certainly be of help when making such decisions.

Science museums, zoos, horticultural gardens etc. play an important part in science education. Training aids such as films and video tapes also are very helpful. There is no science museum in Myanmar and the remaining facilities are available only in towns. Since most of the primary and middle schools are in rural areas, the writer has to assume a total lack of these facilities in planning the contents. This entails much thinking on how to give the student a sound basic understanding of the subject even without such facilities.

## *Nepal*

by Mr. Mohan Gopal Nyachhyon
Primary Curriculum
Development Unit
Ministry of Education & Culture

In 1979 both the Curriculum and Textbook section of the Ministry of Education and the Writer's Division of the Janak Education Material Centre (JEMC) were merged with the Curriculum Development Centre. The merged organization was renamed as the Curriculum, Textbook and Supervision Development Centre (CTSDC). Thus the CTSDC became responsible for the curriculum and JEMC for the manufacture of textbooks.

There is no separate Primary Curriculum Development unit at the CTSD and the result is that the thinking of secondary subject specialists dominates and determines both the contents and the methodology of the Primary Science Curriculum. Because the SLC examination is the termination of school education, the teachers, administrators and specialists focus mainly on subject matter geared to study at a higher level rather than looking at the needs

of the primary students.

Furthermore, because the professional publishing skills of editing, designing, production and management have not existed within the CTSDC, JEMC has been undertaking all this work without referring back to the authors and editors within the CTSDC. They have taken over the publishing function from the receipt of the raw manuscript and the resulting textbooks have not accurately reflected the educational requirements.

Characteristics of Science Textbooks

The existing textbooks were written thirteen years ago and have had little revision. Testing, trials and experimentation has not been a part of the process of development. Material in the books has little logical internal organization and as a result there is no methodology or learning strategy for either pupils or teachers. The books lend themselves to rote learning techniques, memorization and wholesale copying into notebooks. No provision is made for any scientific methods or processes and each book is presented in a flat explanatory style which makes the pupils into very passive learners.

There is very little evidence of child oriented design. Pages are crammed with text and many illustrations are too small for practical use, too detailed for young children, poorly observed and sometimes inaccurate.

There is wide spread evidence to suggest that the physical production specification of the textbooks is inadequate for sustained use in the classroom. The paper tears easily especially from the wire stitching that forms the binding when even light pressure is applied. The covers are very weak.

In 1984 the Primary Education Project (PEP) was implemented with two main goals. First to achieve a low cost quality improvement in primary education and secondly to strengthen the administrative and technical capacity of the education system in Nepal..

Problems in Writing Science Books

Nepal is a mountainous country of wide geographical, cultural and ethnic diversity.

1. to create national curriculum materials relevant to all their real life needs.
2. to incorporate the high content load demanded by the general public with the skills that parents want to see in their children.
3. the low quality of books in Nepal - particularly the lack of good illustrations which convey the intended message and good designs which attract and interest pupils.
4. little understanding of the techniques of producing good quality books.
5. a lack of editorial skills and an inability to commission good writers who can keep a balance between the various aspects of a lesson (pictures, text and exercises).

Financial constraints are probably the most difficult problem facing the education system. They imposed restrictions on the use of colour, size of books, the quality of paper and the possibility of supplying both work books and supplementary books. The lack of finance also hinders the research and testing that is necessary to support a dynamic process of curriculum renewal and development. Testing the manuscripts of text books for objectives and learning outcomes is also limited by financial considerations.

## *Pakistan*

by Ms. Rubina Nazli Goindi
Research Officer
Urdu Science Board

The textbooks produced on scientific and technological topics in Pakistan for children and adults have proved their immense utility in comprehension of science and allied disciplines.

Recently a new trend has been noticed in the reading habits of the school-going children that their interests have shifted form fairy tales to everyday science subjects. It is for the first time that scientific books produced in national languages have provided a very pleasant awareness of the new and upcoming healthy trends in the new culture based entirely on scientific thought and performance.

The only setback in science textbooks written in national languages is that the books are not produced at par with the English science books. They lack the required standard of printing and production. For

want of the needed claim of this discipline the students at times have to apply themselves with a little force. This aversion creates at times a fair amount of reluctance and unwillingness on the part of an otherwise a good reader. But with all the hitches here and there the printing of a scientific textbooks is increasing every year in Pakistan and students feel themselves tie down to scientific subjects not only because of their vocational assurances but for the very thrill and 'kick' of this subject.

In spite of richness in common children literature in Urdu, Pakistani national language, the printed materials on the various scientific and technological subjects is comparatively scanty. Some of the main reasons for that are as follows;

1) The authors are mostly the literary persons and they are not fully equipped with the requirements of those who are capable in writing the books for children on different scientific books.

2) Most of the writers do not cope with the rapid and constant development in the field of science.

3) The scientific literature often lacks psychological approach to produce the material according to the mental levels of the children.

4) Various scientific and technological subjects are mere translations or adaptations form English books. In these books, Arabicised or Persianized forms of terminology which are nor understandable for the children are often used.

5) Illustrations are usually not in accordance with the text because of the lack of knowledge of the illustrators.

## *Pupua New Guinea*

by Mr. Harold Ure
Primary Curriculum Writer
Dept. of Education

The science curriculum in Papua New Guinea is developed by the Science and Maths section of the Curriculum Development Division. The science section takes on the important task of planning, designing and developing the syllabi, teachers guides, and other materials such as poster and charts. Science resource books for students are also the responsibility of curriculum writers. Science educators within the department such as lecturers of Teachers Colleges, Secondary school teachers and lecturers at the territory institutes such as universities are expected to contribute in writing resource books, however this is not the case and the task is therefore thrown back on to the shoulders of the curriculum writers within the Science section. The curriculum writers, therefore are entrusted with a mammoth task of developing all the materials beginning from the primary level to secondary level at Grade 12.

The Education system in Papua New Guinea is more centralized. All the decision for implementation of all material for schools are recommended by the authoritative body, the Primary Curriculum Board of Studies of the Curriculum Division. Following the decision made in the Curriculum Development Division through this body, uniform text books and other resource materials for each grade are recommended through out the country.

With the limited freedom with time and various problems faced in writing resource books, curriculum writers had managed to write several science textbooks which is considered as good effort. In addition to this collection, language and literacy section, a newly created section of the division had contributed much in the publication of several little books in a form of series called Shell Books. These books are written by Papua New Guanines and at a level which primary students can understand. The books cover such subjects as conservation, health and traditional skills. The books are also recommended for use in the schools.

Most books are printed by the department's own print shop. These books are however low in quality and do not last long. There are also books published overseas. These are quality books and are often financed by donor agencies and organizations, such as the World Bank and the UNESCO.

Problems in Book Production

1. Insufficient Funds

As a developing nation, Papua New Guinea's scarce resources and benefits are thinly spread to cover the many developmental areas. Although the Department of Education gets a larger portion of its annual budgetary allocation, the amount allocated to science section does not guarantee such expensive

exercise as publication of good and quality text books nor does it guarantee hire and funding of extra officers to the section which had been a need for the past years. Due to this problem, the section looks for other venues such as assistance from agencies and organizations.

2. Lack of experienced writers, illustrators and photographers

While there may be good writers outside, lack of fund as mentioned above does not allow hire of these writers. The next more appropriate personnel's who could qualify in text books writing are the science educators from secondary, and tertiary institutes, however these officers are more or less regarded as people who have high ideas which are not relevant to situations at the primary. For this reason the most appropriate people would be the primary teachers themselves, however teachers at this level do not have the necessary science background to pursue the tasks.

In the case of illustrator, there are people with illustrating ability, they too cannot make good illustrations with out the science background. Good photographers are however almost nil in Papua New Guinea.

3. Poor Quality of Printing

The printing houses in Papua New Guinea do not have experienced people in specific fields such as science to effectively edit and publish science books. The printing houses in the country do not have the kind of printing materials to produce quality books. The Curriculum Division therefore looks elsewhere outside of the country for publishing of its books. This is considered as an expensive exercise but one that is unavoidable.

## *Philippines*

by Ms. Lourdes M. Ferrer
Professor
Philippine Normal University

Book writing in the primary and secondary level is based on the 'minimum learning competencies' (MLC) and the 'desired learning competencies' (DLC) prescribed by the Department of Education, Culture and Sports (DECS). The MLCs are listings of learning outcomes for the primary grades while the DLCs are those competencies for secondary 1-4.

The development of the MLC for 'science and health' from grades 3-6 is built within the conceptual theme of 'human beings and the environment' while that of the DLC is focused on science and technology. Emphasis in both is on the development of an understanding of how science relates to everyday life, the acquisition of science skills and attitudes necessary to solve problems and the cultivation of desirable personal and social values (including those essential to health).

A series is developed out of these prescribed learning competencies. The series for the primary level (G3-6) simply follows the logical sequence of topic presentation by DECS as contained in the MLCs. The knowledge, skills and attitudes expected to be developed in a primary grade student spiral from the more simple ones in grade 3 to the more detailed and complex in the succeeding grades. The series in the secondary level carries the title Science and Technology 1-4. The essentials of physical sciences, through an integrated approach, and the inclusion of technology are vital components of Science and Technology 1. Science in the other year levels in the series is geared towards biology (Y2), chemistry (Y3) and physics (Y4) with their accompanying technology studies.

Each book in a series has a textbook, an accompanying work-book or laboratory manual (for the secondary level) and a teacher's guide. The textbook-workbook/laboratory manual combination is analogous to 'horse and carriage - you can't have one without the other'. Their complementary functions are highlighted in the teacher's guide.

The topics reflected in the learning continuum prescribed by DECS serve as the core lessons discussed in the textbook. The workbook contains activities in the form of experiments and demonstrations which are linked to the core topics in the textbook. For some books that are intended for private school students, additional activities are intended for private school students, additional activities are included to cater for the varying needs and interests of individual students.

As per requirement in the learning continuum, topics related to health, nutrition and sanitation are directly introduced. Values, especially those inherent in science and scientific investigation, are integrated in the science lessons. For the secondary level, a

technology component is included. Most of the time, it is presented as a separate section in the book.

With the required integration of the aforecited components and the core topics, many book writers find it difficult to provide an effective conceptual bridge linking the core topics and the values/ technology components. This difficulty is just one of the many problems faced by book writers of science in the Philippines.

Problems in Writing Science Books

The following experiences categorized, pose problems in writing science books for children.

Professional - they draw on different professional perspectives and traditions. Many authors still subscribe to the idea that science is a body of facts to be learnt and a set of procedures to be gone through. Science books are heavily laden with facts and procedures in experiments to be carried out by students. This recipe type of learning does not develop conceptual understanding.

Although there is a predominance of factual knowledge and principles, content is rather deficient. Writers concentrate on pure science and pay little attention to its applications. Thus, the skill to transfer knowledge to practical life situations is not developed in students via the textbook medium. There still is, of course, the need for learning basic science (facts and principles). The fundamentals of physics, chemistry and biology are still essential knowledge. However, an effective writer should not overlook the issue of relevance of concepts to the children's everyday life.

There is now a growing realization that other approaches should be made to science. The problem is there seems to be only one approach to use:

Introduction - presentation (activity) - discussion

The order in which various topics are presented should vary and so with examples chosen to illustrate the different principles. It is by choosing proper contextual applications that the author could link science concepts with the surroundings and the daily lives of the people, and make science more relevant and exciting for students.

Organizational - they operate within structural demands on mechanics of writing. The problem of bargaining or negotiation is an issue to contend with. This is the most common method of adjustment through which each side (author on one side and publisher on the other) seeks to reach agreement on a mutually acceptable trade-off. The arrangement often leads to the minimization of independence and autonomy by the author. The customer-oriented publisher has to give in to the demands of the clients - teachers who want a ready-made package, an everything-in-it recipe for teaching science with very little room left for these teachers to put forward creative ideas in teaching. This package often includes a textbook, workbook and a detailed teacher's guide which serves as a lesson plan rather than a resource material for teachers.

Political - they spring out of a major difference in systems of administration. The Philippines has a private and a public school system which utilizes two separate books for their respective clientele. A writer from a private publishing company who wishes to participate in book writing for public school children has to prepare two different books for the same grade level - one that caters to the needs of private school children, and another that simply operates on the minimum learning essentials for the grade level for public school consumption. Two different books perspectives, although content (in terms of knowledge, skills and attitudes) is the same. One is bought by the government, if standards are met, and distributed to public school children, usually one book to four children. The other is marketed by the private publishing company which has to compete with books by other private publishing companies.

Financial - they are subject to different kinds of control and face different demands on resources. Financial problems are always part of the publisher's headache. To cut down cost of production, a black-and-white format is resorted to. More words and less illustrations and pictures are utilized which constitute the major conceptual blocks to understanding by concrete learners. Diversified activities to accommodate various preferences for learning are not provided, for most of these activities entail a lot of art work.

To help students better understand the text, diagrams, illustrations and pictures are needed. Because of financial constraints, these visual aids are not printed clearly, especially black-and-white photos that are commonly used in Philippine textbooks. Strategies that promote integration such as visualization, extensions and analogies that make use of visual presentations could not be utilized effectively due to limited production cost.

## Republic of Korea

by Mr. Kim Joo-Hoon
Director of Science Education
Research Division, Korean Educational
Development Institute

Korea has centralized curriculum system so government determined the national curriculum and all the textbooks are made according to the national curriculum.

One of the merits of centralized curriculum system is standardize the teaching and learning level all around the country. But it has many shortcomings too. The most important effect of centralized curriculum is national wide uniform teaching and learning methods and materials. So almost of the school, similar teaching methods and materials are used throughout the country. Also there are no need for teachers to develop new teaching and learning methods and materials therefore development of diverse teaching methods and materials such as textbooks is not almost impossible in that circumstance. In current Korean educational system diversification or make use of diversity is the most important value to neutralize the traditional centralized curriculum system. In 6th national curriculum there are some endeavours to overcome such negative effects but it's not enough level to minimize the shortcomings of uniformity.

Science curriculum is revised 6 times periodically as the national curriculum is promulgated since 1945.

Periodic revision of national science curriculum has diverse effect to all educational fields. Especially textbook has to be developed according to the new curriculum, there are many affirmative effects periodic revision of national curriculum such as introduction of new trends of science and science education, but there are also many negative effects such frequent promulgation of science curriculum. Usually there are 3 to 5 years lag for textbook production and application of the developed new textbooks to schools. So after only some year application, even before application of textbooks there is revision of curriculum.

So it is better system to revise curriculum longer period of time such as 10 to 12 years and revise textbooks every year. But it is very difficult for Korea to adapt such system because textbook publishing industry is very big so pressures for private part are very strong.

Characteristics of Science Textbook of Korea

1. Primary Science Textbooks

Primary science textbooks are authorized by MOE (Ministry of Education) and only one kind of textbook used throughout the country. 2 books per year because a book is used each semester. In 1st and 2nd grade, the subject name is "Life for Wisdom" and integrated subject namely science and technology. In 6th curriculum, the characteristics of subject changed and integrated subject of science, technology and social studies. The subject name of 3rd to 6th grade is 'Nature' which refers to science.

The primary teaching and learning materials consist of textbooks, student's workbooks and teacher's guides. Textbooks and student's workbooks are color and teacher's guides are black and white.

The primary textbooks are activity oriented so almost of science class consist of activities such as experiments, field work, discussions etc. Total page of textbooks are from 80 to 128 namely very thin textbooks. In such a textbooks it is indispensable lack of information for students such as scientific knowledge, reading materials, introduction of career for science etc.

It is criticized that elementary science textbooks are cookbook style and students only do as the textbook indicated without any scientific thinking, so need more open ended inquiry or discovery learning to overcome such weak points. The format of textbook is also too simple so it is needed to diversify the format for more effective learning.

Most of contents in elementary science textbooks are topics and materials near for the students but still criticized that they are discipline centered and need more meaningful teaching and learning materials for children such as strengthen science for everyday life and science, technology and society.

2. Middle and High School Science Textbooks

Middle and high school science textbooks are produced by private writers and approved by MOE. Five kinds of science textbooks are used in case of middle school and eight kinds for high school. The science teachers in the school can select science textbooks from the approved science books. A total 12 subjects, including English, mathematics, and science are compiled by private authors, subject to

inspection by the Ministry of Education and this trends will be accelerated in the future.

1 book is used each year in middle school. In high school 'Science I' is taught at 1st grade for all students and 'Science II' for nonscience bounded student at 2nd and 3rd grade,. Science bounded students take physics, chemistry and one of subject from biology and earth science at 2nd and 3rd grade.

The teaching and learning materials consist of textbooks and teacher's guide. Textbooks are black and white and two color in 6th curriculum. Total page of textbooks are from 270 to 350 namely very thick textbooks in contrast to elementary school. Too many scientific knowledge and information are provided in the textbooks.

It is criticized that secondary science textbooks stress too much on scientific knowledge and rote memorization rather than scientific thinking and activities such as experiments and discussions, so need more activity oriented teaching and learning experiences, open ended inquiry or discovery learning.

The secondary science textbooks are discipline oriented so most of science classes are lecture style in contrast to elementary school. They need more meaningful teaching and learning materials for students such as strengthen science for everyday life and science, technology and society. Also the difficult contents has to be cut away and quantity of knowledge in the textbook has to be minimized to lesson the burden for the students.

Problems in the Processes of Textbook Producing

1) Shortage of manpower's and researches in the field of basic science education and development of materials needed for science education such as textbooks, instructional methods, instruments and teaching and learning materials etc. is most important problem.

2) National wide science textbook system is needed to complement its problems, diversifying the textbooks. But approved textbook system by MOE also has many problems in current circumstance.

3) Period to produce science textbooks are too short. Some textbook writers prepare for textbook continuously every year but very seldom. Most of textbook writers don't prepare and do research about textbooks.

4) Period to examine and inspect textbooks are too short for middle and high school. Also there is shortage of manpower to inspect the textbooks because most of famous and experienced professors and teachers in the field of curriculum and textbook production are writers of textbooks, and the textbook writers cannot participate as an inspector.

5) There is small chance to modify and complement textbooks if they are produced first, and used for next curriculum revision.

6) Curriculum revision is too frequent it's also one of reasons why the time interval for writing and publishing textbooks are too short.

7) There is no trial edition and application of textbooks for middle and high school. So textbook itself is theoretical one which is far from the circumstances of school science class.

## *Republic of Korea*

by Ms. Kim Yun-Hi
Editor
Youl Hwa Dang Publishers Co.

Problems in writing science books for children & youth

1. the science books require the authentic and accurate reference, illustrations and photos for better comprehension.

2. A few of science specialists are concerned about popularization of science, and writing and producing the science books for children and youth (except for the science textbooks).

3. The writers of the science books have to study and renew their knowledge constantly and keep pace with the development of science and technology. They must know more about the works of their colleagues in other countries so as to bridge the gap between advanced countries and developing countries in science books publishing.

4. For the advancement of science the Government must support scientists and writers who make their efforts for popularization of science.

## *Sri Lanka*

by G.L.Wimaladasa Samarasinghe
Science Book Writer
Director of Youth Employment Planning Division, Ministry of Youth Affairs & Sports

The characteristics of science textbooks

Until the recent past, it was compulsory for all the students in year 6 to 11 to learn science. Planning, implementing and monitoring of teaching science in school have been by the Science Department of the National Institute of Education. Science text books have been prepared and introduced according to the syllabus prepared by the same institute. those textbooks are lengthy and essay type. Those are not attractively readable. The students cannot absorb all the contents in the books due to the imbalance of the time factor with the lengthy syllabus.

Since the science textbooks are printed in black and white, they are not attractive. That leads children to be reluctant to read absorbingly. This situation creates least reference of science textbooks supplied by the government, among the students.

Since teaching science in upper primary grades have been introduced very recently, no textbooks have been prepared by the National Institute of Education. Some of the individual writers have been intervened and introduced some alternative science textbooks for the students in upper primary grades. Most of those science books are not in proper standards. Content, printing and the quality of those science books are not sufficient to the standard laid down by the government.

Major problems in science books for children and youths

1) Most of the people with knowledge of science do not have the skill of writing books. This is one of the main reasons for limited number of science books published in Sri Lanka. Prevailing conditions in the book production field have not been permitted to develop full time writers for science books, as the market for science books is very limited.

2) Quality of science books published in Sri Lanka is poor. Printing papers and other printing materials are very expensive, so the prices of science books are very high. Since the purchasing power of middle class population is low they are reluctant to buy expensive science books.

3) Publishing sector are not organized to accept writer's script to publish even after an evaluation. So the writer himself has to print and publish at his cost, but he cannot afford this type of risk so long.

## *Thailand*

by Mr. Phongchai Sriphan
Specialist The Institute for the Promotion of Teaching Science and Technology (IPST)

The education system in Thailand comprises 6 years of compulsory elementary education, 3 years of lower secondary level, 3 years of upper secondary level. At primary level, science has been taught as an integral part of the Health and Social studies in the Life Experience Group. The curriculum development Center (CDC), Ministry of Education (MOE) has developed general teaching guidelines which include objectives, teaching diagrams and certain activities for all schools to follow. However, supplementary materials such as textbooks or other forms of teaching/learning materials can be developed by other non-government or government agencies. The Institute for the Promotion of Teaching Science and Technology (IPST) is one of those who has been actively involved in the development of the supplementary materials.

At lower secondary level, science is compulsory for all children at grade 7-9. The course materials include textbooks, teacher's guide, science equipment, and other audio-visual materials. The prototypes of these materials are developed by IPST. The publication and nation-wide distribution of teaching materials and the production of equipment are the responsibility of MOE. The MOE then authorizes the Teacher's Association (Ongkarn Kha Kurusaoha) to publishing and distribution for schools throughout the country. Textbooks are normally purchased by the student.

Primary supplementary materials

Since 1977, through the collaboration with the Department of Education Technique, IPST has developed teaching/learning packages. The activity-

learning approach used is emphasized on process so that principles and concepts would be evolved from inquiry and experiment.

Lower secondary science textbooks

The textbooks contain many activities and experiments which questions are asked and the students prove for the answers from observations and from an analysis of experimental results. It is not a text in the traditional sense but a guide to learning in which the learner generalizes and formalizes form the specific and informal, instead of the converse as done in the past. In order to make the books more attractive and interesting, those books are designed for extra activities, cartoon and some space to stimulate the student to inculcate love, interest and curiosity in science and technology.

Problems in writing Science Textbooks

1) Content: The content is too academic and abstract, and the presentation of writing is also difficult that few authors and writers can write this kind of book.
2) Training: The IPST writing team consist of school teachers, supervisors, teacher training college instructors, university lecturers and IPST staff. most of them have never been trained on editorial work or textbook writing.
3) Process of book production: Some editors who work in the government sector which has not its own printing press, have no experiences in printing process, have no ideas to deal with the printers and designers to make the books more attractive.
4) Finance: There are also problems inherent to the technical inspector of the textbook production. budget, high cost printing... in terms of paper and ink. This makes the books be produced with low quality paper and without colors.. Moreover, the price of science books produced have been controlled by the Ministry of Education.

## *Thailand*

by Ms. Petcharapom Roenrom
Educational Officer
Book Development Centre

The characteristics of science textbooks

At primary levels, the contents are integrated in life-experiences which concerns the problems in society. Its main aim is on the scientific process for survival and good living. The contents consist of health, population, politics, government, society, religion, culture, economics, technology, natural environment, communication and so on. However, at secondary levels the contents are specific and arranged by subjects, such as biology, chemistry, physics and physical science.

Also, there is a different in style of presentation. At primary levels, the presentation is in a dramatic style. The stories involve characters and events. The science subject may have less details and students have to look for more information from other sources. At secondary levels, the contents are presented through subject by subject.

However, the characteristics of science textbooks can be concluded that:

1. the style of presentation is rather uninteresting and unattractive
2. the contents are not stimulating
3. the quality of paper and color needs improvement
4. the pictures and illustrates needs more creative ways of producing

The major problems in writing science books for children and youth

1. most writers need higher skill and technique
2. writing science contents in a clear and easy-to-understand style is not easy
3. there are few good illustrators
4. lacking good support and encouragement from the government and private sectors
5. most science textbooks need more budget to make them more interesting and attractive instead of textbooks nowadays with unattractive drawing in black and white on poor quality paper.

## *Vietnam*

by Mr. Phi Hoáng Cuong
Editor/Chief of Booklet Publishing Section
Vietnam News Agency

It is until late 1991 that the "Law on Compulsory Primary Education" has been adopted by the National Assembly. In Vietnam, textbooks officially used in primary and secondary schools are published by The Education Publishing House, one of some thirty

national and provincial publishing houses in the country. A Compilation Board appointed by the Minister of Education and Training takes in charge of the writing of all textbooks, including science textbooks. The compilation of textbooks is specialized but the number of textbooks compiled would be limited and the extra-curriculum textbooks, reference books for pupils remains short of the demands, especially the demands for science textbooks. For instance, the number of all textbooks available to pupils of the 5th form, the last form of primary school, is only 12. As for science textbooks it includes only one arithmetic books and one book on general knowledge, one book on practical works. For lower forms, the general knowledge book is replaced by a book on Health Education. The Health Education books are widely and colorfully illustrated but illustrations in the general knowledge book for the fifth form are monochrome.

Arithmetic books are thicker, from more than 100 pages to 200 pages according to the forms, but other primary science books have only more or less 60 pages. So, each lesson including questions for home work extends only to one or two pages thus it can not provide much reading to the pupils.

Arithmetic books are reprinted annually in 100,000 to 200,000 copies, but other primary science books have a print-run of less than 40,000 copies while the total number of primary pupils in the whole country in 1990-1991 was 9.1 million, so, not every pupil has his own science textbook. Nevertheless, in case the print-run could be increased, not every father or mother is able to buy them. We have to note that for this year, books on Health Education for primary schools have been published with the financial assistance of the United Nations Fund for Children (UNICEF) and are sold under production cost. But the price is still high as compared to the living standards in Vietnam.

We have also to note that most book production cost in Vietnam go to printing cost and printing paper. Royalties to the compilers amount to nearly 2 percent (for textbooks having a high print-run), at most to 6 percent (for science books which have the lowest print-run, sometime only 500 copies). In both cases, these low royalties hardly encourage compilers and writers, and resulted in some textbooks having run for more than 20 reprints without complete amendments.

Apart from the Education Publishing House, all other publishing units do not have the right and the responsibility to produce textbooks, but they have been striving with some success to compensate for this scarcity and deficiencies of science textbooks in our country with the publication of booklet collections. The main target of these popular collections is to provide children and pupils with general knowledge in a systematic fashion and an attractive way. They are produced by some of the national and provincial publishing houses, such as the "Science and Technology Publishing House", the "Information Publishing House", the "Publishing House for Youth", the "General Publishing House of Ho Chi Minh City", the "Kim Dong Publishing House".

These booklet collections enjoy no subsidy from the government or public associations, and their publications have to comply with the profit law and the supply and demand law of the market economy which is installing in Vietnam. The publishers have to produce books that can be sold out in a short span of time. So, these books and booklets must deal with fields and subjects which are interesting to young readers, and they must be sold at the acceptable price. For these reasons, most of these collections are adaptations from science books by foreign authors. Almost the compilers are experts in their own field, so they are able to convey accurate knowledge to young readers in an easily understandable style. These adaptations or excerpts from foreign books amount to half of the number of science books produced in our country for children and youth and contribute a large and an effective part to the popularization of science and technology among children and young people in Vietnam.

## *Colombia*

by Ms. Edith Figueredo de Urrego
Curriculum Designer
National Ministry of Education

According to study by CERLALC (Centro Regional para el Fomento del Libro en América Latina y el Caribe), in Colombia there are about 340 publishing firms and 42 of them elaborate textbooks. Of the last group 4 sell most of the books in the country and they are counted within the 1000 biggest firms of the country. Besides, 15 million books with 4000 titles for kindergarten, elementary School, high school and college are produced annually. Nevertheless, 60 to 80 million of textbooks would be needed to satisfy the students population.

During the last decade the annual growth rate of book production was 13.6% because of the educational politics of the government. However the textbook consumption in the country is still low compared to a population of 7 million students of Basic Education (1st to 11th grade), and also considering that the consumption per capita just reaches three textbooks. It must be pointed out that although Colombia is the second school text producer in Latin America, following Mexico, and exports educational materials to 21 Spanish American countries, there is still a big amount of children without books because their parents cannot afford them or they just don't consider them as a priority expense. Other causes of the lack of textbooks in the classroom are: the teacher doesn't decide to ask for a textbook or the distribution net doesn't reach distant places of the country.

Characteristics of Science Textbooks in Colombia

1. Pedagogical Characteristics

According to a study by MEN-SECAB-GTZ (Educational Materials for Primary Education. National Study of Colombia, 1991) about the most sold textbooks for Elementary Education, the pedagogical quality of science textbooks is high: 84,9 points out of 100 possible. There isn't such a study for High School.. However, the following characteristics can be noted.

1) Integration: They relate the different science fields like Biology, Physics, Chemistry, Science of the Earth and Space, Health and Environment throughout 1st to 11th grade. During the 10th and 11th grade texts develop separately Physics and Chemistry. There are some critics arguing that the first part has a superficial content while the second one has too much theoretical information.

2) Theory-practice: Most of the books integrate theory with field and laboratory activities. However, those experiences are still characterized by being "cook recipes" where the student follows determined instructions with determined results. Thus, there is no place left for dubitation, learning from previous mistakes, hypothesis formulation and personal design of experiments that would allow the student to build knowledge by himself.

(3) Processes-products of science: According to the above information it can be noted that the scientific investigation findings (product) continue being more important than the processes related to the scientific methodology. That's why students develop a disbelief about the character of science. Students think that what books say is an unmodifiable truth, a perfect and complete idea. It's not shown that scientists, just like students, can also have mistakes and that scientific knowledge is provisional and submitted to revision.

(4) Science-technology-society and culture: The textbooks lack usually of a vision that would allow the student to know how the use of scientific knowledge leads to technological development and vice versa. Neither it's analyzed the effect of science and technology upon the society in a determined cultural background and how they do affect its values.

5) Up to date information: Textbooks are way behind the scientific knowledge of investigational fields in the scientific disciplines. Because the authors ourselves don't have up to date information.

6) Attitudes and values: There is concern about values like the respect of life, toleration, etc. But having a glance at the pedagogical treatment of the books, it can be noted that there is much more to expect about the building of the "scientific spirit" and in general, about creativity.

7) Content: Most of the books do emphasis on an universal science leaving aside knowledge about our own natural resources: water. It's important that the student knows about his country, so that he acquires a belonging and national identity feeling.

8) Structure: The textbooks are usually divided in units or chapters, sections and lessons. They contain objectives, activities, summaries and evaluation exercises.

9) Illustrations: It can be generalized, that science books use more illustrations than any others. But sometimes they are complex, lack of names or they are wrong located, and there also might be no correspondence between the text and the illustrations.

2. Publishing Characteristics

Colombian science books usually have a good publishing quality according to a study for elementary education. There is no specific study for the books for high school. In spite of the reports about the good quality of the Colombian publications the following can be noticed:

1) Composition: The type size is often very small in comparison with the student's grade. The sentences and paragraphs are usually very long.
2) Diagramming: There is a good distribution between texts, illustrations, empty spaces and the use of schemes, colors, shadows, underlines, etc. But sometimes this distribution might not be attractive.
3) Illustration: Often there are colored illustrations, but sometimes the drawings and schemes are too abstract for the students according to their grade.
4) Binding: Many books break into pieces easily.
5) Paper: Improved journal paper and paper for books are used.

Major Problems in Writing

1. Many teachers don't accept textbooks that implicate them more work preparing new experiences, consulting other sources and updating. They prefer what they have been working on and they usually use the notes of former students.

2. As consequence, the publishing firms don't accept textbooks with innovations because they are afraid of not selling them since they have not been accepted by teachers.

3. The publishing firms don't offer a previous training to the authors of books but they usually call the teachers. There isn't either a governmental institution to carry out this task; private firms are in charged of the book production. It would be a good idea that CERLALC assume this task.

4. The authors are not usually updated on scientific and technological findings and they neither have access to this information because it's always in English or any other foreign language. They are not updated either on educational and learning theories, means of communication, etc.

## *Kenya*

by Mr. James Kinuthia Karaka
Teacher
St. Michael's School

The report I present is mainly on the Kenyan situation and not summary of the entire African Continent. However, many African countries share similar problems.

Many of the textbooks are written to meet the demands of the country's core curriculum and set syllabus. Most of the science textbooks used in our schools are prepared by the curriculum development research centers and the institutions of education. The centers usually utilize the services of local educators, teachers and lecturers. In addition, many other indigenous authors have written relevant textbooks which have greatly helped to supplement the course books prepared by the centers. These books usually touch on a wide variety of science disciplines. There are books for lower primary (6-8 years) as well as for upper primary ages (9-13 years). There is very little science literature written for the pre-primary ages.

Content and Presentation

The scientific knowledge in our books is written in different forms. Some books present science as theories and "hard" science facts in a descriptive form with little or no effort to develop the child's scientific reasoning. Fortunately, in the majority of the science books, the theory and activity are combined. But it is unfortunate for young children that many of the publications tend to treat the covered topics as very specialized disciplines, e.g., topics for lower primary classes may even be found under headings such as "Light", "Sound Transmission", "Electromagnetism". In so doing the subject may be treated far beyond the level of the targeted reader. The presentation also becomes "hurried".

Science fiction publications for primary schoolchildren are rare. Of the few leisure reading science books available, most are imported form foreign countries. Unfortunately the African child is not able to identify well with such books as these books depict foreign culture, foreign experiences and settings. The other problem is that such imported publications tend to be too expensive for the ordinary parent.

The languages used in most science publications (text and leisure books) are foreign. These being "Second languages" to most of the readers, they find it difficult to follow the instructions in the books fully, especially for pre-primary and lower secondary children.

Characteristics of Children's Science publications in Africa

a) Many of the illustrations in children's books are black and white line drawings, due to the high cost of production. Also, there are very few trained illustrators.
b) The type face in many books is generally too small for the target group because publishers want to print few pages to cut down on the cost.
c) Most of publishing houses don't employ a layout designer but use editors who may not be familiar with layout.
d) The paper quality in some children's books is below standard. Most books are printed on local bond or newsprint, the cheapest paper in Africa.
e) Many publications however have durable paper binding and covers.

Problems in Writing Science Books for Children and Youths in Africa

a) Africa as a whole has very few institutions that provide training in writing, editing and proof reading, illustrating and publishing books.
b) There is lack of a forum for identifying potential writers.
c) Many would-be authors are put off by the high costs of book production sometimes demanded by the publishing/printing industries.
d) Some publishing/printing firms produce physically low quality final products, which do not complete well in the book market.
e) In some cases, the education policy makes the society lay too much emphasis on "passing of academic examinations" thus restricting the author's freedom of writing interesting books for leisure reading.
f) The people generally have poor reading habits, making book writing a financially inferior business.
g) In general, the distribution of finished products needs a lot of improvement.
h) The book industry tends to have a market which is unstable and insecure due to frequent changes in the science curriculums and examination systems.

# APPENDIX

# 1. GENERAL INFORMATION

## Organization

The Training Course on Writing Primary Science Books - 25th Training Course on Book Production in Asia and the Pacific is organized by the Asian Cultural Centre for UNESCO (ACCU) with assistance from UNESCO and with the cooperation of the Japanese National Commission for Unesco, the Japan Book Publishers Association, the Japan Foundation and the Japanese Board on Books for Young People. This course is organized within the framework of Asia Pacific Co-operative Programme in Reading Promotion and Book Development (APPREB).

## Time and Place

The course takes place from 30 October to 16 November 1992 at the Japan Publishers Building (6 Fukuromachi, Shinjuku-ku, Tokyo 162, Japan).

## Background

ACCU organized the training courses for editors and illustrators/designers for science books in 1990 and 1991 as it focused on the development of science books which plays the most vital role in the present society. This is based on the urgent requests of the Member States to upgrade the quality of science books through training of the writers, in order to provide children/youth with accurate scientific knowledge in an easily understandable way and to bring out their interests for science. In this connection, ACCU organizes a course on writing primary science books this year. Also, the participants from Africa, Latin America and the Pacific will be invited to the course with cooperation from the Japan Foundation. This Training Course is one of the Asia Pacific Co-operative Programme in Reading Promotion and Book Development (APPREB) which Unesco organizes for the development of publishing in the region.

## Purpose

(1) To provide the writers of primary science books (mainly for the age group of 10-14) with the knowledge and techniques to produce quality books which are attractive, interesting for the readers, meeting the needs of the present society and which can bring out the interests of readers for science.

(2) To provide the participants with an opportunity to find out the ways to solve the problems related to developing science books and science book writing in respective countries.

(3) To enable the participants to exchange up-to-date information and experiences on science book publishing among the science book writers in Asia/Pacific.

## Participating Countries

*Bangladesh, Bhutan, China, India, Indonesia, Iran, Laos, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Pakistan, Philippines, Rep. of Korea, Sri Lanka, Thailand, and Viet Nam.*
**Africa (Kenya), *Latin America (Colombia)*
*countries participated with the cooperation of the Japan Foundation

## Qualifications of Participants

1) They have engaged themselves in writing science books for children and youth for more than five years.
2) The science books they have actually written are recognized widely and considered to be most excellent publications maintaining highest standard. They will continue to write science books in the future and are responsible for developing science books in the country.
3) They are able to report on the present situation of publishing science books in their own countries and participate in the discussions in English.
4) They are between 25 and 45 years old and in good health and should agree to observe the course schedule strictly and in its entirety.
5) They have not participated in any annual training course in Tokyo organized by ACCU in the past.

## Requirements of the Participants

When applying to the course:
-Two or Three examples of the candidate's work

After the participants are decided:

- Report on the characteristics of science textbooks in his/her country and the major problems in writing science books for children and youth.
- Samples of excellent science books and magazines in their own countries and their own works.

## Working Language

The working language of the course is English. Simultaneous interpretation between Japanese and English is provided for lectures delivered in Japanese.

## Correspondence

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*Participants attended at their own cost.

## 3. Programme Schedule

**30 October (Fri.)**

10:30 Registration
11:00 - 13:00 Opening Ceremony & Welcome Party
13:20 - 16:00 Course orientation

**31 October (Sat.)**

9:30 - 10:30 Self Introduction by participants

10:30 - 11:00 Explanation of NP-Method

11:15 - 12:30 NP-Method Analysis

"Practical & Constructive Suggestions for Producing Good Science Books for Children and Youth"
Ms. Chie Fujita, Writer/Translator of Science Books for Children
Mr. Hiroshi Tsukahara, Lecturer at Tokyo Gakugei Univ.
Mr. Saki Itoh, Editorial Director of Komine Shoten Publishing House

12:30 - 14:00 Lunch

14:00 - 16:00 NP-Metod Analysis continued:

16:00 - 17:00 Plenary Session: Presentation of Group Reports

**1 November (Sun.)** Holiday

observation to Tokyo International Book Fair

afternoon Free

**2 November (Mon.)**

10:00 - 12:00 Visit to Gakugeidai Fuzoku Primary School

14:00 - 17:00 "Science Education in Japan and Science Textbooks"
by Mr. Kazuyoshi Takeda, Lecturer at Tokyo Science Univ.

**3 November (Tue.)**

9:30 - 12:30 "Editing Science Textbooks for Primary Schools" by Mr. Wataru Nomachi, Editorial Director of Science Textbook Div., Tokyo Shoseki Publishers

12:30 - 14:00 Lunch

14:00 - 17:00 "Discovery of Wonders of Nature"
by Prof. Toshitaka Hidaka, Kyoto University (zoology)

**4 November (Wed.)**

9:30 - 13:00 Visit to Ginza Junior High School

14:00 - 17:00 Discussion with the representatives for the Tokyo International Book Fair on "Unesco/ACCU's New Programme on Book Development, "APPREB' and Promotion of Publishing for Neo-Literates in Rural Areas"

**5 November (Thu.)**

9:30 - 12:30 "Writing Primary Science Textbooks" by Mr. Michio Kaneko, Vice Principal at Saitama Primary School

12:30 - 14:00 Lunch

14:00 - 17:00 Workshop on Writing Primary Science Textbooks by Mr. Kaneko

**6 November (Fri.)**

9:30 - 12:30 "Writing Science Textbooks for Youths" by Mr. Kazuyoshi Takeda

12:30 - 14:00 Lunch

14:00 - 17:00 Workshop on "Writing Science Textbooks for Youths"
by Mr. Takeda

**7 November (Sat.)**

10:00 - 12:30 Visit to National Science Museum

**8 November (Sun.)** Holiday

**9 November (Mon.)**

10:00 - 12:00 Visit to publishing house (Kodansha) - discussion with editors of science books & children's books

12:00 - 13:30 Lunch given by Kodansha
(at Chinzanso garden restaurant)

14:00 - 16:00 Visit to the Tokyo University Institute for Solid Satate Physics

**10 November (Tue.)**

9:00 - 12:30 "Writing Science Books (I)" by Ms. Vicki Cobb, writer of science books & children's books

12:30 - 14:00 Lunch

14:00 - 17:00 "Writing Science Books (II)" by Dr. Takahisa Hanya, Emeritus Professor at Tokyo Metropolitan Univ.

**11 November (Wed.)**

9:30 - 12:30 Workshop on Writing Science Books (experiments & observation )

Group A: "Science Experiments You Can Eat" by Ms. Vicki Cobb

Group B: "Our Ecology and Science" by Dr. Takahisa Hanya

12:30 - 14:00 Lunch

14:00-17:00 Workshop (continued)

**12 November (Thu.)**

9:30 - 12:30 Workshop (writing)

12:30 - 14:00 Lunch

14:00 - 18:00 Workshop (continued)

**13 November (Fri.)**

9:30 - 12:30 Workshop (continued)

12:30 - 14:00 Lunch

14:00 - 16:00 Presentation of Works and Evaluation in Group

16:00 - 17:00 Presentation of Works and Evaluation (plenaly)

**14 November (Sat)** Observation trip to Kyoto
**15 November (Sun.)** Observation trip to Nara

**16 November (Mon.)**

10:00 - 12:00 Final discussion
12:15 - 12:45 Closing ceremony
13:00 - 14:00 Farewell party

## 4. List of Lecturers

**Mr. Kazuyoshi Takeda**

Professor at Science Department, Tokyo Science University

Born in 1925. Member of the group for development of instructional guidebook for junior and high school under the Ministry of Education. Former director of Chemistry Research Section, Tokyo Municipal Education Research Center. He has taught at junior and high school and now writer for science textbooks for junior high schools.

**Mr. Michio Kaneko**

Vice Principal,Elementary School attached to Saitama Univ.
Instructor, Saitama Univ. (Education Method, Audio-visual Education, others)

Studied educational science and educational psychology at Saitama University and Tokyo University. After graduation, he has been teaching at Saitama Univ. programme on science. Expert for preparing science curriculum and textbook for elementary level, and science TV programme. He has written several practical guidebooks on science education at elementary school level.

**Mr. Wataru Nomachi**

Editorial Director, Science Textbooks Division
Tokyo Shoseki Publishers

Graduated from Science Department, Hokkaido University. He has been engaged in editing science textbooks for primary and secondary level since 1959 in Tokyo Shoseki Publishers. Now he is editorial director of science textbook division and Assistant Director of editorial department.

**Mr. Toshitaka Hidaka**

Professor of Zoology, Kyoto University

Born in 1930 in Tokyo. Graduated from University of Tokyo in 1952. After his research on endocrine (hormonal) mechaism of color adaptation (protective coloration) in the pupae of butterflies, he got PhD from University of Tokyo in 1961. He is known as the founder of ethology in Japan and making great achievement in the field of ethology, as Governing Council Member of the International

Centre of Insect Physiology and Ecology (ICIPE), leader of Overseas Research Teak on Biology and Behavior of Small Animals in Malaysian Humid Tropical Forests. He has also written many papers and science books.

**Ms. Vicki Cobb**

Born in New York. She received B.A. degree in zoology and M.A. degree in secondary school science. She was the host and principal personality of a syndicated science TV show for children, and has written TV programmes and colums on a magazine. She has written over 50 books for young people and many of them were awarded.

**Mr. Takahisa Hanya**

Emeritus Professor at Tokyo Metropolitan Univ.

Born in 1920. Graduated from Chemistry Dept., Faculty of Science, Tokyo Univ. in 1942. President of The Geochemical Society of Japan. President of The Japanese Society of Limonology. Recipient of Geochemistry Research Association Award, Sankeishinbun Award. He has written many science books and special works onin the field of geochemistry.

**Mr. Saki Itoh**

Editorial Director of Komine Shoten Publishing House

Born in 1947. Majored in Philosophy at Sophia University. He has worked for Komine Publishing House from 1970, editing many science books and picture books for children.

**Ms. Chie Fujita**

Writer/Translator of Science Books for Children

Born in Tokyo in 1931. Graduated from the Faculty of Science in Ochanomizu Women's University. Now a member of Research Society for Science Books. She has written many books including "On Urine and Faeces", "On Waste", "On Sewage", and "Living in Darkness", and edited "Inventions and Discoveries in Everyday Life" and others.

**Mr. Hiroshi Tsukahara**

Member of Society of Science Books for Children
Lecturer at Tokyo Gakugei Univ. and Rikkyo Univ. (Library)

Attained Bachelor's Degree from Tokyo Science University (1971) and Master's from Washington University (1987). From 1971 to 1984, he worked as a librarian at three libraries in Saitama Pref. He was a member of selection committee of children's books from 1988 to 1990. Co-writer of "Story telling", "The Stories of 120 Scientists and Explorers"

## 5. List of Secretariat Members of ACCU

**Toshiyuki Hattori** President

**Tetsuo Misumi** Director General

**Shigeo Miyamoto** Executive Director

**Yasushi Murao**
Director, Book Development and Literacy Department

**Shinji Tajima**
Director, Book Development and Literacy Division

**Taeko Kurokawa**
Unit Chief, Book Development and Literacy Division

**Shigeru Aoyagi**
Assistant Director, Book Development and Literacy Division

**Misako Ohnuki**
Senior Specialist, Book Development and Literacy Division

**Hisako Motoyama**
Specialist, Book Development and Literacy Division

**Rika Yorozu**
Specialist, Book Development and Literacy Division

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